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NUTRITION INTERVENTION IN DEVELOPING COUNTRIES

An Overview

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International Development*

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Office of Nutrition
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Foreword

How do nutrition projects begin? How are specific interventions selected? Who makes the decisions and what is the rationale behind them?

Since such decisions relate to health or food policies of countries and have important implications for budgets, personnel, and other resource allocations, it would be prudent for them to be made only after careful study and analysis. Regrettably, this is not usually the case. More often than not, the choice is a subjective one.

Some interventions are undertaken because they seem "obvious." If many other people are using a certain intervention, it may seem like the right thing to do, and there may be unquestioned faith that it works. An approach may be fashionable at a given time. A particular activity may be promoted by an external agency. Or there may be very attractive offers, such as free food or technical assistance, or a start-up grant.

To the degree that costs are considered, there is usually concern only with what funds are needed to cover immediate and direct costs. The indirect or hidden costs, which may be much greater, are overlooked. Project staff time may be charged to other budgets. The implications for an increased demand on energy or scarce materials may not be considered. There is a tendency to forget overhead costs, such as those for the use of buildings or for heating, cooling and lighting.

Social costs are even more often ignored. Some projects accelerate a change away from traditional practices such as breastfeeding or using natural foods or cultivating home gardens. A project may encourage a welfare mentality, reduce incentives to work, or create lasting demands for convenience foods where packaging and processing may forever raise the price of a food. Obsessed with political needs, decision-makers may not be concerned with long-term consequences, such as the problem of terminating a popular service when it is no longer needed.

Too often these kinds of questions are not addressed, resulting in only marginal effectiveness for many projects. An apparently "good project" (that is, one that is scientifically sound, well-organized, etc.) will bring disappointing results if it is aimed at a problem with which it is not designed to deal. This in turn can lead to a dilemma: whether to continue a project but have no confidence in it or whether to terminate it and admit failure. More often than not, projects go on and on without bringing results but also without being objectively evaluated or analyzed.

Avoiding these problems requires accurate identification of problems, insightful analysis of causation, and a good understanding of interventions in terms of how they work, what they cost, what they achieve, what other consequences they bring, and what preconditions should be present before a particular intervention is selected.

To help deal with the question of intervention selection, the U.S. Agency for International Development commissioned Harvard University to prepare a series of special studies dealing with supplementary feeding, nutrition education, food fortification, formulated foods, consumer price subsidies, agricultural production, and integrated programs. Together, the separate pieces constitute a manual intended to provide guidance for selecting from alternative approaches to reach the preschool child. We hope this effort contributes to an improvement of the process of intervention selection, and thereby to the more effective prevention of malnutrition.

Martin J. Forman
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Bureau of Development Assistance
U.S. Agency for International Development
Washington, D.C.

Preface

In recent years the development community has shown a growing recognition regarding the need to take greater and more concerted action to combat the problem of malnutrition in the developing world. Interest has increased in methods for more rapid alleviation of the pressing problems of malnutrition than that which accompanies the normal course of economic growth. Efforts to develop national nutrition policies and to engage in nutrition planning have become common. In this context, policymakers, international development professionals, researchers, and managers have focused on nutrition intervention as a means of channeling additional resources more quickly and effectively to nutritionally needy groups.

Unfortunately, this interest has often turned to frustration because information about the usage, design, costs and effectiveness of these interventions has been scarce, fragmented, and of questionable quality. In an effort to address this problem, the Harvard Institute for International Development (HIID) undertook a project for the Office of Nutrition of the U.S. Agency for International Development aimed at filling, in part, the information gap on nutrition programs in developing countries. Through a literature review, a mail survey, and filed studies, we attempted to gather and integrate sufficient information to enable us to present a representative, although not

exhaustive, view of the major nutrition interventions. In particular, we have tried to identify the salient factors that planners should consider in designing these interventions. The limitations in the scope of our undertaking and in the availability and quality of data restrict, of course, the conclusiveness of our findings. Although the data should be viewed as tentative, we hope that they will partially fill the previous knowledge and information gap and that they will provide useful guidance to professionals operating in the nutrition field. We also hope that we have laid a foundation on which others can build by both extending and refining our work.

This multiyear project would not have been possible without the original vision and continued support of Dr. Martin Forman, Director of the Office of Nutrition of U.S.A.I.D., and his staff, particularly Hope Sukin and Marian Frazao. Their patience, encouragement, and advice were invaluable. Also essential was the institutional and intellectual support provided by HIID's former Director, Lester Gordon, and by the HIID professional and administrative staff. They were able to accommodate to the inevitable vicissitudes of a multidisciplinary, multicountry, multiperson project--a tribute to their long experience with field projects and their interdisciplinary perspective. The support of this project also reflects HIID's holistic view of development and its commitment to address a broad spectrum of socioeconomic problems confronting the Third World.

Special appreciation also goes to John McArthur and Lawrence Fouraker, current and former Deans of the Harvard Business School, respectively, Dean Howard Hiatt of the Harvard School of Public Health, and Dr. Robert Geyer, Chairman of Harvard's Department of Nutrition, for giving me the flexibility and support to undertake and direct a project of this scope and nature.

I would like to extend my deep gratitude to my coworkers for the great pleasure that has been mine in working with an outstanding group of collaborators. The contributing authors to this overview volume and the accompanying special studies brought to the task practical field experience, academic training, good will, and dedication. The scope of the project demanded the expertise of people in many different disciplines and professions. The research team included nutrition scientists, medical doctors, economists, administrators, political scientists, sociologists, epidemiologists, and policy specialists. The range and level of development of their skills are reflected in the resourcefulness and ingenuity of their treatment of a world of subject matter.

In addition to this overview volume, edited by myself and Marian F. Zeitlin, with chapters contributed by our coauthors, seven supplementary studies have also been published:

- Volume 1
Study I Supplementary Feeding
Mary Ann Anderson, James E. Austin, Joe D. Wray,
and Marian F. Zeitlin
- Volume 2
Study II Nutrition Education
Marian F. Zeitlin and Candelaria S. Formacion
- Volume 3
Study III Fortification
James E. Austin, Thomas K. Belding, David Pyle,
Florentino S. Solon, Thomas L. Fernandez, Michael C.
Latham, and Barry M. Popkin
- Study IV Formulated Foods**
Jerianne Heimendinger, Marian F. Zeitlin, and James
E. Austin
- Volume 4
Study V Consumer Food Price Subsidies
Beatrice Lorge Rogers, Catherine A. Overholt, Eileen
Kennedy, Federico Sanchez, Adolfo Chavez, Thomas
K. Belding, C. Peter Timmer, and James E. Austin
- Study VI Agricultural Production, Technical Change, and
Nutritional Goals**
Richard H. Goldman and Catherine A. Overholt
- Volume 5
**Study VII Integrated Nutrition and Primary Health Care
Programs**
James E. Austin, Thomas K. Belding, Richard Brooks,
Richard Cash, Jonathan Fisher, Richard Morrow,
Nancy Pielemeier, David Pyle, Joe D. Wray, and
Marian F. Zeitlin

Chapters 4 through 10 in this overview volume provide summaries of these studies.

In addition to the substantive collaboration of these colleagues, several institutions shared their energy and time generously. In particular, CARE; Manoff International; Syntectics, Inc.; the Instituto Nacional de Nutrición (Mexico); the Instituto Colombiano Agropecuario (Colombia); and various governmental agencies in several

developing countries collaborated in the development of case studies. Many other organizations provided us with information and institutional cooperation. This generosity is a manifestation of their commitment to contributing to the united effort to combat malnutrition.

Innumerable colleagues gave generously of their time in reviewing the many drafts of the supplementary studies. Their insights and suggestions greatly strengthened our undertaking. I am particularly grateful to Alan Berg and Jim Levinson for their ideas and encouragement throughout the life of this project.

A vast amount of typing, administrative coordination, and editing was necessary to get these studies into print. Many individuals contributed, but special thanks go to Karen Mitzner, Melanie Mahin, Sara Hazel, Beverly Vidler, Marilyn Pirkle, and Phyllis Gestrin. Extra appreciation is extended to Ross Giacobbe and Aimee Hamel for their extraordinary work in readying the manuscripts of the seven supplementary studies.

Finally, a very special thanks goes to Dr. Marian F. Zeitlin who, as Associate Project Director, brought to the project total dedication and outstanding technical competence. Without her exceptional efforts, the project could not have achieved its goals.

The demands of this project on its many collaborators were intensive and extensive. The common and sustaining motivation was simple: a deep desire to contribute, at least in a modest way, to the task of alleviating the scourge of malnutrition. If these works help others to do that, our efforts will have been well worthwhile.

James E. Austin
Project Director

Introduction to Nutrition Intervention Series

James E. Austin and Marian F. Zeitlin

I. PURPOSE

One out of every two people in developing countries is malnourished. For the very young, malnutrition is lethal. It is a major contributor to the alarmingly high infant and child mortality rates in these countries. The insidious nature of malnutrition is particularly disturbing: it is both a consequence and a determinant of underdevelopment. It is fundamentally a product of poverty, yet in turn it erodes a country's human capital, thus further tightening the web of poverty. The deprivation caused by malnutrition stands out as an intolerable denial of a basic need and human right.

Governments and international agencies have increasingly recognized not only that malnutrition is a constraint on development but also that its alleviation is a valid measure of development. Social welfare programs involving nutrition are not new; traditional mechanisms have existed in most countries to benefit some of the hungry. However, efforts of governments have been intensifying, both to reorient general development programs to generate nutritional improvement and to mount direct nutrition programs aimed at providing greater and quicker nutritional benefits to needy groups.

The basic purpose of this overview volume and the companion Special Studies on nutrition intervention in developing countries is to

provide guidance to professionals in developing countries, in international agencies, and in research institutions involved in planning, designing, funding, operating, or evaluating nutrition programs.

As was suggested in the preface, a common problem that these various professionals have faced in carrying out their different tasks has been the scarcity and fragmented nature of information on specific types of nutrition interventions. The experience of developing countries with nutrition programs is extensive, but it has only been documented in a partial and piecemeal fashion, often without a programmatic or policy orientation. Our studies are an attempt to remedy, in part, those deficiencies by distilling and consolidating much of the existing nutrition program information into a single set of documents and by presenting that information in terms of guidelines for designing the major types of nutrition interventions. Thus, this volume and the Special Studies represent a partial, but representative, assessment of the "state of the art" of nutrition programs.

The main purpose of this overview is to provide a summary of, and introduction to, the other studies in this series; this represents a condensation of the series. It presents an integrated and abridged view of the interventions and thus provides basic guidance to planners, policymakers, researchers, and administrators. The seven individual studies indicated in a subsequent section cover the material in greater depth and breadth; the reader is urged to consult them.

II. LIMITATIONS

It is important to recognize that the insufficiency of, and imperfections in, existing data on nutrition programs have imposed serious limitations on our studies. As an illustration, one can note that of 201 nutrition projects in countries that we surveyed by mail, only about 20 percent had systematically collected and analyzed program cost and nutritional impact data. Even when such data have been collected and reported in the literature, the quality has often been deficient or unverifiable.

To offset these limitations partially, we complemented our mail survey and selective review of published and unpublished literature with field case studies of projects in each of the main intervention categories. Although these additional analyses provided valuable information and insights, they were relatively few in number and also limited in scope. Consequently, one should view our analyses and guidelines as tentative, warranting further empirical verification.

Even though our knowledge of the state of the art is partial and in some aspects lacks precision and conclusiveness, it was suffi-

cient to identify key factors in designing nutrition programs. Therefore, our research findings do provide a usable framework with sets of intervention design parameters that can fruitfully be applied now. More nutrition evaluation is critically needed, but existing knowledge is sufficient to permit countries to move forward with their nutrition programming. In this context, it is also hoped that these documents will provide a base upon which subsequent research can build.

The scope of these studies is limited in two additional ways. First, the nutrition programs examined give primary emphasis to reaching preschoolers and pregnant and lactating women. This focus was dictated by the contractual terms of reference of the research. It also makes good sense because these are the groups that are nutritionally the most at risk. Adults and school-age children also have nutritional problems, but they tend to be less life threatening. Nonetheless, adult malnutrition can adversely affect productivity, and school-age malnutrition may hinder learning capacity. The second limitation is that we do not examine all types of interventions. For example, we do not discuss agrarian reform, food marketing systems, food processing, storage loss prevention, or generalized income redistribution. Action in these areas and others could produce nutritional benefits. Our exclusion of them does not imply a denigration of their potential but rather reflects the limits of our resources and the terms of reference of our research.

III. ORGANIZATION

The seven special studies in this series deal individually with the main types of nutrition programs employed in developing countries. The seven studies are:

- I. Supplementary Feeding
- II. Nutrition Education
- III. Fortification
- IV. Formulated Foods
- V. Consumer Food Price Subsidies
- VI. Agricultural Production, Technical Change, and Nutritional Goals
- VII. Integrated Nutrition and Primary Health Care Programs

The authors of each study are indicated in the preface and in Chapters 4 through 10 in this volume. Each of these studies uses a basic format, which covers the following topics:

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- I. *Overview*, which defines the intervention, presents its rationale, and estimates the extent to which this type of intervention is used in developing countries.
- II. *Intervention design*, which is the heart of each study and provides the key design parameters and guidelines.
- III. *Evaluation*, which includes estimates of the costs and nutritional impact of the interventions.
- IV. *Case study*, which consists of analyses by project staff of one or more field interventions, to illustrate, partially, the methodology presented in the study's previous chapters.

This *Overview* follows a different organizational format. The next chapter presents a simplified conceptual framework for viewing the interventions in their totality and defines and describes individual nutrition interventions. Chapter 3 presents a general approach for evaluating any nutrition program. Chapters 4 through 10, which are the main part, present summarized analyses of each of the seven intervention categories. The final chapter presents selected additional policy and program conclusions derived from the study.

To increase the utility of the *Overview* as an information resource and operating guide, we have included two sets of appendixes. Appendix A contains selected bibliographies on nutrition planning and evaluation (Chapters 2 and 3) and for each of the seven intervention categories (including the references cited in Chapters 4 through 10 in this volume plus those cited in the seven Special Studies). Appendix B provides a series of abbreviated checklists that can be used to review design issues for each intervention.

Chapter 2

Nutrition Interventions: A Conceptual Framework

James E. Austin and Marian F. Zeitlin

I. ELEMENTS OF A CONCEPTUAL FRAMEWORK

Nutrition interventions are planned actions that introduce new goods or services into the existing food system for the explicit purpose of improving the nutritional well-being of designated groups. The potential effectiveness of nutrition interventions can best be realized if they are planned and designed within a larger conceptual framework. What are the most important elements of this framework?

Although individual nutrition interventions can be and have been mounted as separate activities, nutrition intervention has been most successful where it was viewed as an integral part of a country's overall development efforts aimed at improving the well-being and productive potential of the poorer groups (Winikoff 1978). Thus, *the first element of the conceptual framework is the specification of nutrition's role in the country's general development strategy.*

Nutrition efforts, like other development undertakings, require the mobilization and organization of political actions, economic resources, and institutional activities. Such tasks are most efficiently and effectively performed when explicitly planned. Consequently, *the second element in the conceptual framework is an explicit nutrition planning process.* This process, described in the next section, encompasses prob-

lem diagnosis, goal specification, intervention design and selection, program implementation, and evaluation.

The success of that process will depend to a great extent on how the intervention design and implementation phases are handled. Thus, a *third element is the systematic identification and analysis of the key design dimensions of the nutrition interventions*. This design process should particularly encompass factors that are critical to the implementation phase. Careful and realistic design will minimize subsequent implementation problems.

The multiple etiology of malnutrition requires that various causes and their effects be addressed simultaneously by different intervention mechanisms. Therefore, the *final element of the conceptual framework is an integrative perspective*. The planner must understand the role that each intervention will play, how it relates to other interventions, and where and how it will have an impact on the institutional structures in the existing food and health system, and in turn how these structures will have an impact on the intervention.

We will now examine the nutrition planning process and then the rationale and relationships of the nutrition interventions.

II. NUTRITION PLANNING

This book and the other studies in the series do not deal with the total nutrition planning process. The focus is primarily on two components of the process: the design and evaluation of various types of nutrition intervention. However, it is important to delineate the larger planning framework and process within which the intervention analysis occurs.

During the 1970s various researchers and policymakers designed and to some extent implemented a wide range of methodologies for nutrition planning. Table 2.1 briefly describes four such approaches; the reader is referred to the references in Appendix A-1 for further detail. Rather than discuss in detail the pros and cons of these methodologies, we have distilled out a simplified nutrition planning framework. Using this framework, the planner should examine five basic areas. The rigor with which the various questions can be examined will depend to a great extent on the available human resources and data.

1. *Problem Diagnosis*

—Who is malnourished?

—What type of nutritional deficiency exists?

Table 2.1 Nutrition Planning Approaches

<i>Type of Methodology</i>	<i>Major Proponents</i>	<i>Main Features</i>	<i>Institutions Using the Methodologies</i>	<i>Countries Using the Methodologies</i>
"Systems analysis" approach	Berg with Muscat 1973 Pines (Office of Nutrition 1973) Call and Levinson 1973	Systematic problem-solving process. Analysis of nutrition problems and their causes using readily available data. Formulation of specific time phased, costed-out objectives (quantitative, if possible). Selection of interventions using cost-benefit analysis. Evaluation and reprogramming. Fairly pragmatic approaches.	The World Bank AID	Colombia, Brazil, Philippines, Indonesia, et al.
"Nutrition-based development planning" approach	Joy and Payne, 1975	Emphasis on malnutrition as aspect of deprivation syndrome. Scientific diagnosis of nutrition problems. Development of "functional classifications" and "typical profiles." Establishment of goals, objectives, and targets. Choosing of interventions. Area-level planning. Emphasis on elegance and completeness.	FAO	Philippines, Sri Lanka
Policy formulation approach	Toro (United Nations 1978)	Formulation of food and nutrition policies for inclusion in development plans. Stimulation of awareness of nutrition factor. Problem diagnosis, policy definition, and program area determination. Incorporation of nutrition objectives, policies, and programs in national and sectoral plans.	PIA/PNAN	Nine Caribbean and Latin American countries.
Community nutrition approach	Wilson	"Bottom-up" as opposed to "top-down" planning. Systematic approach at local level. Community involvement and action encouraged. Cooperatives formed. Self-help approach. Community members serve as extension workers.	PNAN	Colombia, Philippines

Source: Lynch 1979.

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- How severe is the deficiency?
- Where is the target group located?
- What are the causes of the malnutrition?
- 2. *Goal Specification*
 - What are the nutritional improvement goals of the country's development program and the specific objectives of direct nutrition interventions?
 - Are the objectives quantifiable in terms of groups and deficiency reduction?
 - Over what period will the impact be achieved?
- 3. *Intervention Design and Selection*
 - What types of interventions would most effectively alleviate the deficiency in the short and longer run?
 - How should the intervention be designed to fit best the local conditions and to overcome local administrative, social, political, and economic barriers?
 - How much will the intervention cost relative to its nutritional impact? (See evaluation questions.)
 - How should different types of interventions be meshed with each other?
 - How can the specific nutrition interventions best fit with other types of development activities?
 - How can other development policies and programs be oriented to improve the consumption effects on needy groups?
- 4. *Program Implementation*
 - Which organizations and individuals will have what responsibilities in managing the various interventions?
 - How will the organizations interrelate?
 - What will be the funding mechanisms?
 - What will be the timing of implementation?
- 5. *Evaluation*
 - What are the purposes of the evaluation?
 - Who are the users?
 - What are their specific needs?
 - What is the appropriate data collection, analysis, and dissemination system?
 - How well was the intervention delivering the intended goods or services?
 - What behavioral and physiological impact on the target group was achieved?
 - What are the causes for lack of impact?

Elaborating and implementing a national nutrition plan is a complex and organizationally difficult undertaking. Multiple institutions

and disciplines are involved. Achieving effective interaction among institutions has been a common problem area in most countries' nutrition planning efforts. To be effective, a new nutrition strategy will often require new organizational structures. Among those proposed have been nutrition planning units. According to Joy (1973, Appendix A-1), to operate most effectively, the head of the national nutrition planning unit should have "de facto" status higher than ministry heads in order to be able to require information from, and influence budgets of, ministries. Table 2.2 delineates the possible responsibility of such a unit.

In only a few countries have strong nutrition planning units emerged. It may be more feasible to have individual ministries and agencies incorporate nutritional considerations into their ongoing activities than to create a totally integrated national nutrition program with power concentrated in a separate nutrition planning unit. The organizational form should be compatible with the institutional constraints present in each setting. No "standard form" exists that will ensure positive results.

The order in which the planning steps should be carried out has been the cause of both disagreement and some disillusionment with nutrition planning. Some planning groups have viewed analysis of the nutrition system and the causality of malnutrition as steps to be completed before the selection and implementation of large-scale interventions could begin. In several instances, planning procedures have been prolonged for years without substantially improving existing policies or service delivery systems.

Ordering steps in a time schedule or work plan is different from ordering them according to logical phase. Diagnosis of the nature of the nutrition problem precedes selection and implementation of solutions, in the sense that the justification for any given intervention strategy derives logically from the problem diagnosis. However, diagnosing the causes of a problem as complex as endemic malnutrition is an ongoing iterative process that depends on feedback from all the other steps. To a certain extent, nutrition planning must be a learning-by-doing process.

Ongoing improvement of existing nutrition interventions on the basis of existing information is required from the start of planning, not only for the sake of service delivery, but also in order to construct the feedback cycles between the information base and the interventions that are central to the planning process. Furthermore, many of the design characteristics of interventions cannot be planned in the abstract because they depend on human interactions and other factors for which there are no quantitative, predictive models. Planning and implementation (whether on a full or pilot ba-

sis) must proceed simultaneously, with ongoing evaluation providing the needed feedback.

For these reasons, planners should seize opportunities from the beginning to improve existing programs and to arrange for the implementation of promising new interventions at as large a scale as can be justified by information immediately available to the unit, by institutional capabilities, and by political feasibility.

A final point to emphasize is the importance of involving program beneficiaries in the planning process. An abstract, top-down nutrition plan has little chance of succeeding; rather, the malnourished must both want and shape the plan that is to respond to their reality.

III. RATIONALE AND RELATIONSHIPS OF INTERVENTIONS

As noted earlier, malnutrition is both a consequence of, and contributor to, the complex web of poverty and underdevelopment. Over a billion people in the developing world are malnourished (Reutlinger and Selowsky 1976). As countries develop, the numbers of seriously malnourished generally decline. However, this general development process and the resultant nutritional improvement is slow. If current trends in income growth and distribution and agricultural production continue, by 1990 there will still be several hundred million people in the developing countries suffering from caloric deficits in excess of 250 calories per day (Reutlinger and Selowsky 1976).

The basic role of nutrition interventions is to accelerate nutritional improvement by special mechanisms that channel increased resources to the most nutritionally vulnerable groups. Although the effectiveness of nutrition programs has often been questionable and data imperfect, the evidence is sufficient to conclude that interventions can have a positive impact on nutritional well-being. Furthermore, with improved design and implementation, the impact of future programs can be greater than past efforts. Even in the more developed nations, governments have recognized that such special nutrition programs are necessary to meet the needs of groups who suffer from nutritional deprivation in spite of the country's high level of development. For example, in the United States 47 percent (\$9.5 billion) of the Department of Agriculture's budget in 1979 was allocated to nutrition interventions. The use of nutrition interventions holds across a wide spectrum of political systems, as is witnessed by the intensive use of targeted nutrition programs by countries as politically different as Cuba and the Philippines.

Table 2.2 Nutrition Planning Unit Responsibilities

1. To define the nature, magnitude and causes of malnutrition at present and as it seems likely to develop in the future.
2. To propose nutrition objectives and priorities and to assist in the ranking of nutrition goals in relation to other development goals.
3. To identify strategies and measures relevant to the reduction of malnutrition and also strategies and measures that seem likely to aggravate malnutrition.
4. To appraise ministry and area programs for their impact on nutrition.
5. To report, through the Secretary of the Plan Organization, its findings with respect to the above.
6. To assist ministries and area planning teams in the design, appraisal, and selection of nutrition programs.
7. To monitor (or to arrange for independent monitoring to the extent appropriate) the impact of various measures—explicitly nutritional and otherwise—on nutrition status and on the achievement of national nutrition objectives.
8. To propose and undertake measures to build capacity for data collection and analysis in order to carry out the above function.

Source: Joy 1973

Nutrition programs should not be viewed as substitutes for other measures aimed at accelerating the development process and at adjusting basic socioeconomic structures to remove inequities and poverty. Rather, if they are designed and implemented properly, they become vehicles promoting the needed change process. However, like any other programmatic resource allocation, they can be used as palliatives, excusing more fundamental efforts or even exacerbating the position of the poor by increasing dependence and stifling other actions. Our perspective is one of viewing nutrition interventions as part of a larger development effort in which there is a clear government commitment to meeting the basic needs of the population. Thus, although we concentrate on specific types of nutrition programs, it should be remembered that their design and implementation should be viewed and carried out within the context of a larger development strategy and process.

The various types of nutrition programs are directed at overcoming the consequences of different causal factors. Figure 2.1 shows in simplified form the causal factors at which the interventions are directed and at which stage in the food system the intervention occurs. The dotted lines connecting some of the interventions indicate that they should generally be carried out jointly due to their complementarities. For example, the introduction of new formulated weaning foods into the diet often will require that the parent be taught their importance or how to prepare them; similarly, formulated foods might be one of the commodities used in supplementary feeding programs, or formu-

lated foods might be subsidized in order to increase their accessibility to the lower income groups. As Figure 2.1 also shows, some of the interventions address multiple causes. For example, supplementary feeding attempts to overcome problems of deleterious habits and low purchasing power; it could also address the problem of inadequate quantities of food in a distributional rather than production sense.

The definition and rationale for the seven types of interventions that we examine are as follows:

1. *Supplementary Feeding.* This category consists of supplementing the normal diets of vulnerable groups (preschoolers, pregnant and lactating women) with the types of food needed to alleviate their nutritional deficits. First, because of the poverty of the family, the food is usually provided either free or at a nominal fee. Second, the type of food given and the focus on the vulnerable groups is aimed, along with nutrition education, at overcoming certain habits or beliefs that restrict the consumption of available nutrients by these groups.
2. *Nutrition Education.* This intervention is aimed at improving the utilization of existing good-quality food for the nutritional betterment of vulnerable groups. It strives to alter purchasing, preparation, and feeding behavior to counter certain deleterious food-related habits that have been found to exist among varying income levels.
3. *Fortification.* This intervention attempts to overcome specific nutrient deficiencies in the diet by adding the missing nutrients to a commonly consumed food when it is processed. Thus, one is addressing a quality constraint in the local food supply. Generally, the nutrients added are vitamins or minerals, rather than calories or proteins.
4. *Formulated Foods.* This intervention consists of creating new highly nutritious weaning foods aimed at meeting the special needs of the child during the critical six- to thirty-six-month age period. During this rapid growth period, the child's nutritional needs are accelerated and exceed the capacity of the mother's breast milk; also, foods in the traditional diet often do not have sufficient nutrient density and quality to meet these needs. Thus, new foods must be created through mixing foods in new ways in the home or through industrial processing. As mentioned previously, nutrition education must generally accompany the introduction of these formulated foods, which are also often used in supplementary feeding programs.
5. *Consumer Subsidies.* This type of intervention is aimed at reducing the cost to consumers of specific foods, thereby increasing the

STAGE

INTERVENTION

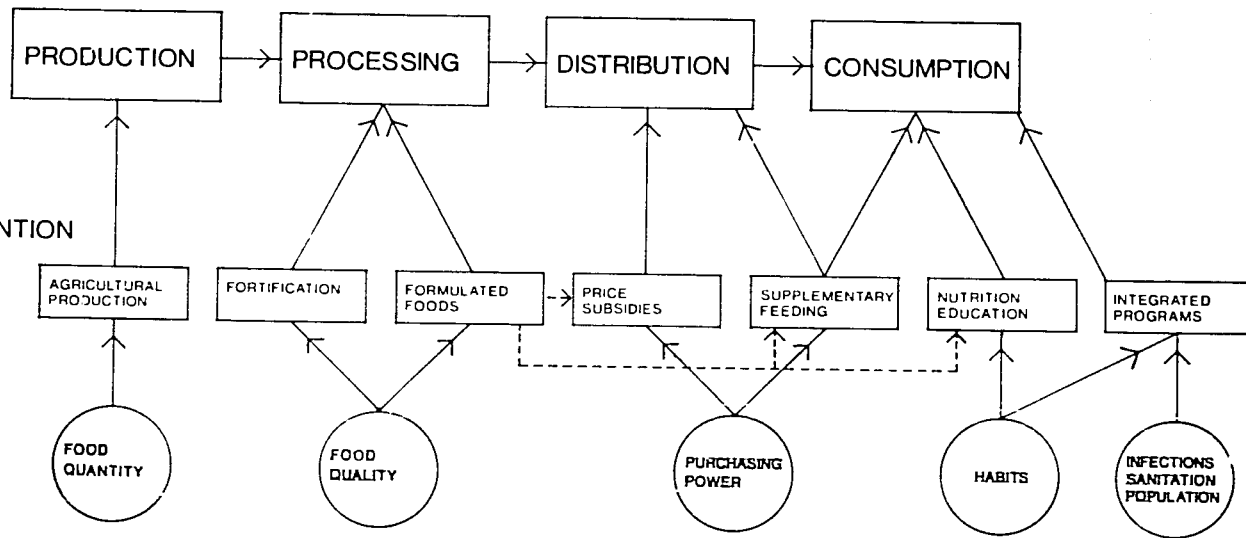
CAUSAL
FACTOR

Figure 2.1 Nutrition intervention relationships.

target groups' access to needed nutrients. The form of the subsidy can vary (for example, food stamps, ration shops, price controls). Formulated or fortified foods as well as staples could be among the types subsidized.

6. *Agricultural Production*. From a nutritional standpoint, this intervention is primarily aimed at increasing the quantity of food available to the needy groups. Generally, agricultural policies have not been shaped with explicit nutrition criteria, and this has sometimes, ironically, resulted in adverse nutritional effects on needy groups. The nutritional impact of increased production can come through income (or food) increases to small farmers or landless laborers or through its effect on prices of foods consumed by the needy groups.
7. *Integrated Programs*. Nutritional well-being is closely linked with health, given the interactive nature of infectious diseases and malnutrition. Similarly, nutritional status and population variables are intimately linked. There is growing recognition of these interdependencies and the need to attack nutrition, health, environmental, and demographic problems simultaneously and in an integrated fashion.

As mentioned previously, these seven interventions do not encompass all the types of programs that can be used to improve nutrition, but they do encompass the main categories of programs. A further limiting aspect of the scope is our focus on preschoolers and pregnant and lactating women. These groups, however, are believed to be the most nutritionally vulnerable, the most deprived, and the least able to rectify their nutritional situation without explicit interventions. This is not to say that other groups' nutritional needs should not be attended to, but only that analyzing programs aimed at them is beyond the scope of this work.

The various interventions should not be viewed as mutually exclusive, but rather as complementary actions that can be aimed at multiple causes. It is also important to recognize that these interventions may intrude into ongoing systems because their presence is potentially disruptive; this is true even when the community has been heavily involved in the design and operation of the intervention. One must predict the nature of that disruption in terms of the reactions of the individuals and institutions that the intervention will affect. Only through such prediction will one be able to design the program so that its effectiveness and efficiency will not be eroded by these groups' reactions.

Evaluation

James E. Austin and Marian F. Zeitlin

I. INTRODUCTION

Evaluation is the neglected piece of the nutrition planning process. Evaluation is often perceived as a threat, a technically difficult task, a drain on scarce resources, and a political risk (Austin 1978). Yet, evaluation can provide critical feedback that links intervention implementation to planning. If properly carried out, evaluation can measure program performance against objectives specified during planning in order to provide useful information to planners, policymakers, funding agencies, researchers, program operators, field workers, and recipients. A critical first step in the design of any evaluation system is to identify who the end users are and what their information needs are.

Figure 3.1 presents a general inventory of user information needs for nutrition program evaluations, with suggested formats and schedules (Zeitlin and Austin 1978). Planners, funders, and policymakers (listed above the central line in the figure) generally need to know if the program is having a positive impact and is making good use of the allocated resources. Program operators (listed below the line) require information for the ongoing functioning of the program to know if the delivery system is operating as planned. Both types of information concern different aspects of the effectiveness of the program: the for-

mer focuses primarily on the biological and economic performance, whereas the second concerns the administrative procedures that affect program costs and impact.

This chapter will present a simplified evaluation framework. Although the general methodology suggested is meant to be broadly applicable, planners should tailor the evaluation scheme to their particular needs and resource constraints. Because an entire book could be devoted to the various dimensions of evaluation methodology, we will simply present a basic frame of reference through which planners can relate evaluation to the task of intervention design. Elaborations and refinements are, of course, possible and desirable. (For further references, see Appendix A-1).

II. MEASURING THE EFFECTIVENESS OF NUTRITION INTERVENTIONS

The evaluation framework can be viewed as a means for examining in different ways each of the main dimensions of the intervention program. These include the following:

1. *Inputs*—the goods (food, materials) and services (labor, logistics) allocated for the intervention. The evaluation will document the costs and quality of these inputs and assess the appropriateness of the intervention design for these inputs.
2. *Outputs*—the result of the combined inputs; they represent the end product that the intervention delivers, i.e., implementation. The effectiveness of the delivery system in providing the outputs to the right groups in the right quantities (e.g., percent of target groups covered, percent of deficit covered) is assessed at this point. Outputs are intermediate indicators because without delivery there is no impact.
3. *Outcomes*—the impact that the intervention has on the behavior and nutritional and health status of the target group. The effectiveness indicators deal with behavioral and physiological changes (e.g., in anthropometry or mortality).
4. *Benefits*—the ultimate social and economic benefits derived from the improved nutritional and health status (e.g., improved longevity, productivity, intellectual capacity, or well-being, decreased health care costs). Quantifying these ultimate benefits is very difficult. The technique of social cost benefit analysis can be applied to a certain extent and, although not discussed here, is illustrated in the appendix to Special Study III in this series (*Fortification*).

Level	Evaluation Users	Adaptive Decisions	Types of Nutrition Information Required	Form of Data Collection and Preparation	Schedule
International or Bilateral Agencies	A. International Assistance Agencies	A* Ranking of countries by need	A* Malnutrition prevalence by country	Sample surveys	Every 3-10 years/country
National/Regional Planning Bodies	B. Planners/Funders	A. Ranking of development needs and ranking of cost effectiveness of nutrition programs relative to development needs	A. Development benefits to be gained from investment in nutrition relative to other sectoral synergies, etc.	Intersectoral analyses of evaluation results of related development activities measured against development needs	Every 1-5 years
National/Regional Ministries of Health, Agriculture, Etc., Nutrition Institutes	C. Sectoral Policymakers/ Administrators	A. Ranking cost effectiveness B. Needs of nutrition programs relative to nutritional needs C. Determining optimal mix of nutrition strategies together with other sectoral activities. Making administrative adaptations to seasonal fluctuations in need	A. In depth cost effectiveness B. Analysis and evaluation of impact in impact related to project goals design and operation and to access, income, behavioral and environmental factors	Sample survey plus longitudinal program records Base line and control group and computerized analysis, if financially feasible	Every 1-2 years/program
Program Headquarters	D. Program Administrators		A. Annual reports of operations B. and of nutritional status C. Malnutrition prevalence by region by season	Reports of review teams Program records, weight chart summaries by hand tabulation	Annually
Field Offices	E. Program Administrators F. Field Workers	D. Determining optimal mix of program activities and goods and services provided to recipients. Day to day supervisory decisions	D. Staff reports, discussions, regular conversations with field workers and beneficiaries D. Clusters. Accounting measures E. of delivery effectiveness, nutritional status records, performance of individual workers and activities	Scheduled meetings, interviews and site visits, refresher seminars, accounting records, weight chart records, written reports, dietary surveys, planning sessions	Quarterly to daily
Community	F. Community level Workers	D. Determining mix of activities E. Use of time and resources F. Supervisory decisions	D. Meetings and discussions E. Between community level and higher level program staff F. to determine response to programming efforts, growth chart records	Scheduled meetings, interviews and site visits, weight charts	Monthly to daily
Community	G. Beneficiaries	D. Deciding best ways of using opportunities E. Information and goods provided by the program	D. discussion with community level workers, nutritional status records, occasional G. discussion with higher program staff	Scheduled meetings, informal home visits, growth charts	Monthly to daily

* User groups are indicated by letters beside the decision and information columns.

Source: Zeitlin and Austin (1978), pp. 29-30.

Figure 3-1. Nutrition Program Evaluation—User Information Needs Inventory.

Table 3.1 presents a summary listing of this evaluation framework and illustrative indicators for inputs, outputs, outcomes, and benefits. These indicators can be grouped into two categories: *outcome indicators* showing whether or not the program improved nutritional conditions and at what cost; and *intermediate indicators* examining administrative performance and thus being useful for determining how, why, and under what circumstances a given program was or was not effective. In evaluating alternatives, the analyst should relate costs to the outcome indicators. Because resources are scarce, one should seek to design interventions that achieve the greatest impact relative to the costs expended. Control groups should also be used where possible. Thus, a series of cost-effectiveness outcome indicators emerge—e.g., cost per change in infant mortality rate (or per death averted), cost per nutritionally improved child (or per malnutrition case averted)—as well as intermediate indicators showing what percent of the target group was being reached or how much of their nutritional deficit was covered, or what portion of the food was diverted to nonneedy groups. For further details on evaluation indicators, see Austin (1978;1980). These outcome and intermediate indicators will now be examined in more detail.

A. Outcome Indicators

The final measures of program impact are physiological and will vary according to the purposes and resources of the program. A project to supplement pregnant women with iron, for example, will probably need to test hematocrits and hemoglobin. A vitamin A fortification project will probably involve testing serum vitamin A of representative subsamples of individuals. A nutrition education program directed at improving weaning diets will have to determine not only whether education led to behavior change (a necessary but insufficient condition for biological impact) but also whether infant weights improved.

Since malnutrition may result in high mortality rates and in growth retardation, two sets of indicators prove particularly useful: mortality statistics and anthropometric measurements. Clinical symptoms and laboratory assessments may also be used.

1. Mortality. Children from birth to three years suffering from third-degree malnutrition have been found to have mortality rates six to twenty times as high as children of normal weight (Kielmann and McCord 1978). Although the reliability of the data underlying these estimates is not entirely certain, it does not seem unreasonable to assert that improvement in nutritional status leads to reduction of the

Table 3.1 Evaluation and Indicators

INTERVENTION COMPONENTS				
	<i>Inputs</i>	<i>Outputs</i>	<i>Outcomes^a</i>	<i>Benefits</i>
I N D I C A T O R S	Costs	% TG ^b	Δ Behavior	Productivity
	Quality	% TG reached	Δ IMR ^b	Earning power
	Design	% deficit covered	Δ 1–3 MR	Health savings
		% leakages ^c	Δ Morbidity	Well-being
			Anthropometry	
			Clinical signs	
			Biochemical Indicators	

^a These outcome indicators should be related to the costs of the interventions.

^b TG = Target Group; IMR = Infant Mortality Rate.

^c Leakages refer to food intended for the target group but diverted elsewhere due to such factors as storage or handling losses, consumption by nontarget group individuals, malabsorption, and substitution for existing foods.

infant mortality rate (IMR) and the one- to three-year-old mortality rate. This appears to be particularly true in programs offering both health and nutrition surveillance, where early detection and treatment of malnutrition and illness also help keep children alive. Community-level nutrition and health interventions in several countries have reported decreases in preschool mortality of up to 50 percent (Gwatkin et al. 1979). Mortality reduction may be an earlier indicator than increased average weights because severely malnourished children who are kept alive may pull down the averages. Disadvantages of using mortality as an indicator for evaluation are that large samples are required for statistical significance (but not for observing trends) and that the indicator is less sensitive for children over thirty-six months old.

2. Anthropometric Measurements. Measurements of weight and height (or supine length for children under two years) are the most sensitive indicators of nutritional status of infants and young children. Weight for height measures wasting, and height for age measures stunting. Birth weight also is an excellent indicator of maternal nutritional status during pregnancy. In addition, arm circumference can also be used for assessment of nutritional status

independent of age between about six months and four to five years. It has also been proposed that thigh circumference be used (Zeitlin et al., in press).

The World Health Organization (WHO 1978) provides reference standards of weights and heights of preschoolers for international use with a discussion of the derivation of these standards and methods of calculation. Previous methods using percentages of standard weight for age, height for age, and weight for height (all calculated by dividing the actual value for the individual child by the expected value for age, or height) are giving way to the use of standard deviation scores to express the same three measures. There are two reasons for this change: the standard deviations of the three measures do not correspond to the same changes in percent (e.g., one standard deviation is equivalent to about 5 percent height for age, versus about 10 percent weight for height and about 11 percent weight for age); and standard deviation scores allow an immediate assessment of the severity of the problem in terms of percentage of individuals who fall below the score versus the number who would fall below if nutritional conditions were normal.

Table 3.2 summarizes some of the strengths and limitations of various anthropometric measurements. Multiple measurements are desirable to obtain a fuller assessment of nutritional status.

3. Clinical Assessment. Clinical signs of malnutrition are discernible physical characteristics that can be seen or felt. Some of those characteristics are the following:

Tongues, lips, gums

pale grey color: indicative of iron deficiency

cracks or sores: suggestive of vitamin B deficiencies

bleeding: points toward vitamin C deficiency

Hair

discoloration, lack of lustre, easily plucked, flag sign: suggestive of protein deficiency

Eye

xerophthalmia, pale conjunctiva, Bitot's spots, xerosis: suggestive of vitamin A deficiency

Goiter: diagnostic of iodine deficiency

Skeleton

bossing skull, knock-knees, bow legs, enlarged wrists: usually caused by vitamin D deficiency

Edema: suggestive of protein deficiency

Most malnutrition, however, is subclinical; only a small percentage the malnourished population will manifest clinical signs.

Table 3.2 Anthropometric Measurements

<i>Indicator</i>	<i>Strengths</i>	<i>Weaknesses</i>
Weight for Age	A sensitive growth status indicator; weight charts feasible to use and helpful educational devices.	Age data often not precise; weighing errors possible; scales needed.
Arm Circumference for Age	Good screening tool; fairly easy to administer; equipment minimal and inexpensive; can be used age independently by village level workers.	Lacks sensitivity in measuring short-term growth improvement
Weight for Height	Useful where accurate age assessment not possible for younger preschoolers	In later preschooler age children, stunting may occur and should be considered in interpreting results
Height for Age	Measures chronic malnutrition in the form of stunting.	Is not sensitive to short-term changes; height or length measurements often inaccurate.

4. Laboratory Assessment. Biochemical analyses of various bodily fluids—e.g., blood, urine—can reveal specific nutrient levels. Tests are available for vitamin A, the B-complex vitamins, vitamin C, calcium, folate, protein, and trace minerals.

These tests are generally quite accurate, although errors can occur in the drawing and handling of the sample when different analysts carry out the tests. The equipment and personnel needs are much greater, as are the corresponding costs, than they are for anthropometric measurements. However, for certain types of interventions, such as fortification, biochemical analysis is necessary.

B. Intermediate Indicators

Intermediate indicators measure how well the intervention's delivery system is functioning. The specific indicators will vary according to the type of intervention. Among those that can be used are target group coverage, leakages, reduction of the nutrient deficit, and behavioral change.

1. Target Group Coverage. The impact of a program will, in the first instance, depend on the extent to which food or services actually reach the intended group. This implies the need to have surveyed, in

some form, the population to assess how many people are nutritionally vulnerable and to have set a goal for the number to be reached by the intervention. Some interventions may reach people other than those in the target group. These constitute leakages.

2. Leakages. Food or services could be unintentionally provided to families who are not nutritionally needy or members of needy families who are less nutritionally vulnerable than the preschoolers or pregnant or lactating women. These diversions should be estimated because they increase program costs without enhancing biological impact. If control measures to reduce these diversions can be introduced at less cost than the value of the diverted resources, overall cost effectiveness could increase.

3. Reduction of Nutrient Deficit. A third indicator is the extent to which the intervention is reducing the target group's nutrient deficit. The accuracy of measures of food intake developed to date has been questioned; dietary recalls are fraught with memory and honesty problems and the possibility of observer bias. However, all the established methods—including twenty-four-hour recall, weighed food intake, diet history, and food diary—can still provide valuable information. The lack of program impact may be caused by the failure of the delivery system to reach the target group with an adequate quantity of nutrients. The single twenty-four hour recall is relatively inexpensive and does not appear to introduce any more error than multiple observations. In examining infant diets, however, it is useful for the mother or caretaker to provide recalls for infants between birth and about thirty months. Above this age, the children are mobile enough to eat significant amounts of food without the mother's knowledge. For this reason, it is useful to limit the age of the sample of preschoolers under dietary investigation to under thirty months.

4. Behavioral Change. Nutrition education aims to create changes in the food-related practices of the target group under the supposition that such changes will lead to improved nutritional status (i.e., biological impact). Thus, knowledge and attitude changes should lead to behavioral changes. All three should be monitored, for if behavior changed but nutritional status did not, it would suggest that the nutrition education message was wrong or that some other factor was the stronger deterrent to growth.

These intermediate indicators or others should be examined because if there was no impact, the planner wants to know why. These indicators help identify what aspect of the administrative system was faulty and allow one to adjust the operations accordingly. The indicators be-

come more useful when they are matched to a set of operating goals (such as percent coverage, tons delivered, messages received, practices changed) and financial budgets. This creates the basis for a management information and control system.

III. APPROACHES TO EVALUATION

Measuring the impact of an intervention on the nutrition and health status of a target group of preschool children is a technical procedure that falls within the domain of social science research. For any given program, the evaluation procedure should follow in a straightforward manner from the requirements of the program; it should not be mystifying. To deal with a large variety of program types and specific needs, however, a great many options must be available for evaluation. The language used to describe these options tends to be somewhat technical. The following list indicates some of the characteristics of frequently used kinds of evaluations or evaluation procedures.

Informal—no statistical methods. A review team makes one or more site visits; interviews program managers, field staff, and beneficiaries; reviews project materials, records, and accounts; and writes an evaluation report. Informal evaluations are appropriate for pilot projects that have recently started or for small projects with diverse objectives, such as community development.

Formal—uses statistical methods and tends to be comprehensive. It is appropriate for projects that deliver the same goods and services to a large target group.

Process—determines how and how well processes function. This type of evaluation, which may involve the use of anthropological methods, is essential for understanding how a program works.

Summative—has as its main objective finding out whether the program was effective. Because this evaluation method does not involve analyzing why or how the program could be improved, it is not sufficient for planning purposes.

Formative—small-scale experimentation with program design to develop the most effective, efficient, or acceptable design features. This method is not yet widely used.

Comprehensive survey—collects and analyzes a range of data designed to answer both summative and formative questions. It involves both sociological and econometric methods.

Small sample—tends to investigate groups of five to thirty people. It is used for materials pretesting and for product testing.

Large sample—investigates groups of 100 to more than 1000 people.

It is used to evaluate impacts.

Cross-sectional—collects information only once across different groups.

Longitudinal—collects information at more than one time on the same sampling unit, e.g., a single person or group of persons.

Management Information System (MIS)—a feedback system that reports information about program management at varying levels.

Materials pretesting—preevaluation of educational and information materials before they are mass produced. This is essential to avoid costly information expenditure on ineffectual items.

Product testing—preevaluation of new foods and recipes for nutritional quality and acceptability before they are produced and distributed. This kind of testing is essential for same reasons that materials pre testing is essential.

IV. TECHNICAL DEMANDS

A final comment is in order regarding the personnel demands of mounting evaluation systems. If these systems are to provide useful information to the various users, they must be carefully designed. Furthermore, they should be viewed as an integral part of the intervention and incorporated into the overall planning process.

This implies an initial investment in planning the system so that it is technically sound, practicable, and affordable. The objective is not to create an elaborate and highly sophisticated system. Rather, one should strive for a system that will gather as little data as is necessary to provide the various end users with the minimum amount of information needed to carry out their tasks. This approach of tailoring the system for user needs and striving for simplicity while retaining reliability is, however, a technically demanding task. Consequently, it is highly desirable in the beginning to obtain the needed technical assistance in designing the evaluation system. Evaluation specialists may be costly initially, but their costs are not continuing ones and should be viewed as a necessary part of program start-up costs.

If properly designed, an evaluation system is likely to justify its costs by improving the ability of program-related personnel to operate the intervention more economically and effectively. The absence of reliable cost and impact data represents a major impediment to more effective nutrition intervention, which urgently needs to be rectified.

Supplementary Feeding

*Mary Ann Anderson, James E. Austin,
Joe D. Wray, and Marian F. Zeitlin*

I. DEFINITION AND RATIONALE

As noted earlier, the supplementary feeding programs on which we focus distribute free or subsidized foods to preschool children and to pregnant and lactating women. These programs use one of three formats: (1) nutrition rehabilitation centers (NRCs), which provide a complete diet to severely malnourished children, who usually remain at the center at least during the day; (2) on-site feeding programs, which provide one or more prepared meals at the center to larger numbers of children and sometimes to their mothers; and (3) take-home programs, which distribute commodities weekly, biweekly, or monthly.

Such programs are estimated to have reached about 50 million preschool children and mothers in 1979. Supplementary feeding programs for school-age children, which are even more common, distribute more food. Whereas take-home programs appear to be the most common form, some countries, such as India, have reported more than half of preschool feeding to be on-site (Austin et al. 1978). Rehabilitation centers are least common, in part, because severely malnourished children requiring intensive rehabilitation are always only a small percentage of those in need. Table 4.1 itemizes the strengths and limitations of the three distribution systems for feeding preschoolers.

Table 4.1 Strengths and Limitations of Various Types of Supplementary Feeding for Preschool Children

<i>Type of Feeding</i>	<i>Potential Strengths</i>	<i>Potential Limitations</i>
Nutrition rehabilitation center	<p>Promotes rapid rehabilitation of severely malnourished, thereby freeing hospital beds</p> <p>Assures consumption of total RDA by avoiding problems of sharing and substitution of the ration</p> <p>Provides for continuing surveillance</p> <p>Involves mother in recuperation of child through mandatory education and work shifts</p> <p>Creates self-sufficiency by use of locally available, affordable foods</p> <p>Prevents relapse, maintains growth of graduates</p> <p>Prevents malnutrition among siblings</p> <p>Enhances cost effectiveness because it is targeted</p>	<p>Limits coverage because of the lack of beds</p> <p>Does not directly reach other children in family</p> <p>Increases costs because of provision of total daily diet, kitchen and eating facilities, and high staff-to-patient ratio</p> <p>Fails to acquire maternal participation in educational activities</p> <p>Fails to provide education consistent with economic limitations</p> <p>Creates possibility of cross-infection</p> <p>Removes mother from home, other children, and job (especially residential SRC), and may cause lost wages and inconvenience</p> <p>Requires dynamic, dedicated person in charge</p>
On-site	<p>Assures consumption of ration in intended quantity</p> <p>Possibly more rapid growth and recovery than with take-home feeding</p> <p>Day care and child-feeding facilities provided for working mothers</p> <p>Provides opportunity to educate children and prepare them for primary school</p> <p>Provides opportunity for psychological stimulation, socialization, and normal mental development especially through mixing malnourished with well-nourished children</p> <p>Generally serves larger numbers of children than SRC's</p> <p>Assures growth surveillance; monitoring is easy</p> <p>Provides maternal education through participation (as in SRC's)</p> <p>Costs per person served are less than for SRC's</p>	<p>Reaches few children under two years old</p> <p>Ration is frequently substituted for the home diet</p> <p>Takes responsibility for child feeding away from mother and creates dependence</p> <p>Kitchen, eating facilities, staff, and cook are expensive</p> <p>Provides low coverage, with attendance limited to batches of thirty children</p> <p>Generally has low geographic outreach</p> <p>Creates possibility of cross-infection</p> <p>Inconvenience of daily attendance sometimes a problem</p>
Take-home	<p>Has high geographic outreach</p> <p>Covers children under two years old</p> <p>Convenient for mothers because of less frequent distributions and fewer lost wages</p> <p>Provides high coverage, with attendance of up to 600 children per center</p> <p>Less expensive than on-site because fewer facilities and staff needed</p> <p>Minimizes cross infection risk</p> <p>More realistic maternal education achieved through home treatment</p> <p>Home treatment can act as a nutrition education demonstration in distant communities</p> <p>Ration can be fed in more frequent, smaller portions than is possible in on-site, resulting in higher nutrient intake despite bulk limitations</p> <p>Program located in a health center may promote greater use of health facilities</p> <p>Treats the malnutrition problem in its milieu</p> <p>Emotional disturbance reduced because child is not moved to new environment</p>	<p>Sharing and selling of rations result in high diversion to unintended groups</p> <p>Achieves slow growth and recuperation</p> <p>May not be sufficient for the severely malnourished child</p> <p>Distribution site may be too far for people to travel</p> <p>Provides less opportunity for education because of infrequent food distribution</p>

Source: Study I.

II. KEY DESIGN QUESTIONS

To maximize effectiveness and minimize the weaknesses of supplementary feeding programs, several key intervention design categories must be evaluated and provided for. These categories include community involvement, participant selection, food type, food quantity, time dimensions of the program, location, site facilities, and logistics and control. The following key design questions provide guidelines for planning.

A. Why Is Community Involvement Important and How Can It Be Achieved?

Community involvement in accepting, designing, and managing supplementary feeding programs leads to greater understanding, commitment, and impact. In a nutrition rehabilitation program in Madurai, India, for example, the centers with the greatest impact were found in communities that had the greatest understanding and involvement (Venkataswamy and Kabir 1975b). Community involvement in planning and operating feeding programs appears to improve impact by providing the neighborhood-level supervision and social approval that are required to motivate regular attendance, accountable use of the distributed foods, and other behavior changes taught by the program. Such involvement can also help ensure that the design of the feeding program is tailored to overcome the constraints on participation of the neediest members of the community, e.g., locating the center nearest to them, arranging hours compatible with their schedules, and ensuring their knowledge of the program. In the Philippines, the Asia Research Organization (1976) found irregular attendance to be the main reason for failure of growth improvement in response to the targeted maternal-child health feeding program. Attendance in two take-home programs in India was found to range between 53 percent and 61 percent unless there was individual house-to-house supervision (Cantor Associates 1974; Gopaldas et al. 1975). A number of programs have reported that several months were required to gain mothers' trust before they were willing to feed substantial quantities of new foods to their infants. However, when health workers who were members of the community started a feeding program in Candelaria, Colombia, significant results were evident within three months (Wray 1978a).

Community involvement also lowers costs, reduces the numbers of dropouts, and generates user feedback, which can indicate that the program design should be adjusted to improve both efficiency and effectiveness. Communities may be able to provide land, feeding cen-

ters, storage facilities, and/or foods. The community may also appoint and support program personnel. In Indonesia, rural mothers were involved in conducting weighing sessions for children in their neighborhoods; the community then used the results to identify and decide how to tackle its own nutrition problems (Hendratta 1976). Indonesian community volunteer programs have distributed both donated foods, such as nonfat dried milk, and local foods, such as fermented soy beans (tempe), and string beans. Parental involvement has been increased in several Catholic Relief Services programs in Africa (Capone 1977) through a feeding program in which the parents agree to the terms of a formal contract at the time the child is enrolled. The parents must agree to give the ration or home equivalent daily in addition to the child's usual diet, bring the child promptly for health care, and participate in the growth chart program. In exchange, center personnel agree to instruct the parents in these three basic procedures and provide the food supplement.

The nature of community involvement for a given program should be worked out with community leaders who have sufficient authority to mobilize resources. To motivate local investment and commitment and to increase self-reliance, it is frequently desirable for the program to offer to provide services to the community on a "matching funds" basis.

Although community participation offers many potential benefits, it should also be recognized that it is not necessarily easy to elicit. There are no ready formulas; each community has its own social fabric and dynamics. Thus, the form of participation and the process of generating involvement will vary. Outsiders can play a useful catalytic and liaison role in the process; however, the precise nature of this role in nutrition programs has not been widely documented.

B. Who Should Participate in Feeding Programs and How Should Participants Be Selected?

The scarcity of resources demands that donated or subsidized foods be targeted to those who are most in need. Because of their acute nutritional vulnerability, the key target groups are children from six to thirty-six months and pregnant and lactating women from low-income families. The six- to thirty-six-month period is particularly critical because this is the age at which permanent nutritional stunting most often occurs and the age at which the combined result of inadequate feeding of solid foods and frequent episodes of infection is high mortality rates. Maternal supplementation during pregnancy and lactation is a preventive intervention for both mother and child. Supplements

during the last trimester have produced higher birth weights, which increase chances of survival and nutritional well-being during the weaning crisis. Supplementation of the lactating mother can increase the quantity of breast milk and the duration of breast feeding.

Children who are malnourished are at much greater risk of dying in the absence of intervention than those who are normal (Kielmann and McCord 1978). They also are able to improve in growth in response to the program, whereas those who are more nearly normal may not be able to benefit as much (Asia Research Organization 1976). For these reasons, child enrollment should give first preference to those suffering from third-degree malnutrition (weights less than 60 percent of standard weight for age, or less than 80 percent of weight for height) and next to those with second-degree malnutrition (less than 75 percent of weight for age, or 90 percent of weight for height). Better-nourished children may be admitted if they have "at-risk" characteristics. Preschool siblings of the malnourished or at-risk child may have to be included in order to make participation practical for the mother. A composite list of risk factors drawn from several experts (Cameron and Hofvander 1977; Ghosh et al. 1976; Shah et al. 1974; Cutting 1972) follows:

Birth weight less than 2500 grams

Twins

Breast milk failure or problems

Failure of mother to gain 500 grams per month during first trimester of pregnancy and 250 grams during second trimester

Sixth or later child in birth order

Death of siblings under twelve months

Single-parent family

Measles, whooping cough, tuberculosis, repeated diarrhea

Low economic status

Similarly, if one wants to minimize cost by including only at-risk pregnant and lactating mothers rather than all such mothers, certain characteristics may be used to identify beneficiaries. The following at-risk factors have been proposed by K. Shah (1975) for India:

Maternal height less than 145 centimeters

Maternal weight less than 38 kilograms before pregnancy or 40 kilograms at the twentieth week of pregnancy

Maternal weight gain of 1 kilogram after the twentieth week of pregnancy

First pregnancy

Multiple pregnancies

C. What Foods Should Be Used for Supplementary Feeding?

Numerous studies throughout the world have shown that caloric deficiency is frequently more severe in preschool children than is protein deficiency (World Health Organization 1976; Gopalan 1975; Gopaldas et al. 1975; Jacob 1975; Beaton and Swiss 1974; Beghin and Viteri 1973; FAO—WHO 1973; Hegsted 1972). We cite this extensive list of references because the primary orientation toward proteins continues to persist among many planners of feeding programs. Obviously, protein is important. What is critical is to strike the right balance. With this abundance of evidence, it is clear that special attention should be given to reformulating rations so that they can adequately close the calorie gap as well as the protein gap. The extra calories should come from oil, fat, sugar, whole milk, or oil seeds that have not been defatted, such as groundnut paste (peanut butter) or full fat soy flour. A serving of prepared food that a one-year-old can finish at a single meal should contain about 300 calories, about 11 grams of protein, and required vitamins and minerals.

The choice of food will be determined by the degree of acceptability to the recipients and by nutritional adequacy. Availability and cost also are important, particularly in deciding whether to use local or donated commodities.

Only 18 percent of recipient children receiving Whey-Soy Drink Mix in Pakistan were found by the CARE evaluation (reported in the case study to Study I, *Supplementary Feeding*) actually to be drinking the supplement, because it was considered unacceptable. In order to avoid waste of this sort, new foods must be tested in repeated acceptability trials held in the setting in which the food will be consumed. The fact that children will accept a food offered in a center does not necessarily mean that they will be given the food at home, as their mothers may consider it to be unattractive. Large-scale promotion may be necessary to introduce unfamiliar foods. Although infants have been shown to prefer sweetened to unsweetened foods, acceptability of other characteristics probably depends more on the mother than on the child.

The main problem with a cereal (or root staple) diet is that it is too bulky to provide sufficient calories or protein for the young child. A twelve-month-old, for example, would have to eat about two liters of plain rice or sorghum porridge to satisfy calorie and protein requirements. For this reason, the diet offered in supplementary feeding programs should be concentrated sources of protein and calories. This may be achieved by feeding a specially formulated food alone (see Chapter 6). Protein content should be calculated as a per-

cent of total calories, and it should ideally make up 15 percent for the recuperation of malnourished children (Meredith, Closa, and Rio 1977).

Another approach to overcoming the bulk constraint is to increase the frequency of the feedings; thus, smaller amounts of the staple can be given at each feeding.

Most supplementary feeding programs use some local foods, but some continue to rely on imported foods. There are particular advantages and disadvantages to using imported commodities in supplementary feeding programs, which the planner can take into consideration:

Advantages

Large-scale, efficient production is achieved by well-established manufacturers with high standards of quality control.

Opportunity is present to fortify or enrich staples because of availability of equipment and technical support.

Food aid sources are available to low-income countries suffering from food shortages due to disaster, drought, insufficient production, and so on.

Such foods provide a temporary means of mobilizing local commitment to child nutrition programs.

Such foods may be cheaper than locally processed foods due to large-scale, high-volume production.

Disadvantages

The local government may not take responsibility for the nutritional well-being of its people because of reliance on donated foreign surpluses.

Programs are subject to the availability of commodities, which constantly vacillates depending on weather, agricultural yields, prices, and donor policies. Also, it may be difficult to keep mothers continuously actively participating in a program in which the ration keeps changing.

The foods may have poor acceptability because they are foreign.

Recipients may develop dependence on foreign assistance and fail to learn how to use locally available commodities for treatment and prevention of malnutrition and for achieving self-sufficiency.

Imported foods compete with local initiative to produce indigenous weaning foods.

There is often an overemphasis on high-protein, soy-fortified products because most imported supplementary food products have these characteristics.

There may be greater probability of spoilage because of long-distance shipment and extended storage.

D. How Should the Size of the Supplement Be Determined?

The supplement size should be based on the average per capita nutrient deficit of a representative sample of malnourished children. Well-nourished children obviously should be excluded from this calculation. Deficits can be determined through twenty-four-hour dietary recalls or by weighing foods, if resources permit this more expensive method, and should be examined at different seasons. A calorie requirement of about 150 calories and a protein requirement of about 3 grams per day per kilogram of body weight may be used for deficit calculations for preschoolers. Based on our analyses and judgment, we have set this amount above FAO 1973 requirements because the malnourished child's ideal weight on which requirement should be based is higher than his or her actual weight (see Table 4.2).

The ration size must be larger than the average deficit to compensate for leakages or diversion of the supplement through intrafamilial distribution and substitution of the ration for the normal diet. Studies reveal that about one-half of the individual's ration in take-home programs is shared with other family members or may be sold to outsiders. In on-site programs, from one-third to one-half may be used as a replacement for foods eaten at home. Some of this replacement is inevitable since a child who eats two meals away cannot be expected to receive two extra meals at home. These leakages should be investigated in the individual program. In certain cases, the appropriate response may be to increase the size of the ration to as much as double the deficit. In other cases, remotivation of the community and education of the mothers, in particular, to orient the foods toward the preschoolers may reduce the leakage problem. Sale of the ration tends to be a problem when the foods distributed have a ready retail value in local markets.

E. What Should Be the Time Dimension of the Program?

Program timing needs to take into consideration periods of maximum vulnerability, convenience of the participants, and the length of participants required for recovery from malnutrition. Within the previously defined vulnerable groups, the first six to twenty-four months of infancy and the last trimester of pregnancy can be highlighted as crit-

Table 4.2 FAO/WHO 1973 Energy and Protein Requirements for Preschool Children (Sexes Combined)

Age	Average Weight (kg)	Requirement per kg per day		Requirement per person per day	
		Energy (Kcal)	Protein (g) ^a	Energy (Kcal)	Protein (g) ^a
6-11 months	9.0	108	2.6	795	23
1 year	11.3	105	2.1	1190	24
2	13.5	100	2.0	1350	27
3	15.5	100	1.9	1550	29
4	17.5	98	1.8	1715	32
5	20.4	91	1.7	1860	35
6	22.8	86	1.6	1960	36

^aAdjusted for a diet with a protein quality of 60 percent relative to milk or eggs.

ical periods. Continual supplementation from the sixth month of pregnancy through the third year of life presumably could protect children from the weaning crisis, although their eventual return to a marginal diet would probably produce temporary growth failure. Unfortunately, it has proved difficult for nutrition programs to have an impact on children under two years of age who are most in need because their mothers tend not to be able to bring them to feeding centers daily and because these infants are less able to compete with older siblings for foods in the home. The mother on whom the infant depends must be motivated through nutrition education to take initiative in improving the child's diet.

In rural areas in particular, the entire population may suffer nutritionally during "hungry seasons" preceding harvests. The size of the ration and program coverage should be increased at these times, and the schedule of food distribution should be adjusted to planting and harvest work requirements.

Timing of on-site meals and of distribution of take-home rations should be determined by amount of staff time, participant convenience, shelf life of the ration, and opportunities for diversion. It may be appropriate to try different schedules at different centers during a formative evaluation period to determine which are most serviceable. Travel to the center, the amount of food that can be carried, and the speed with which extra rations are likely to be consumed are important considerations for take-home programs. Frequent small meals improve intake in on-site programs.

The only way to determine appropriate length of participation is to monitor the growth of the children, and to "graduate" those who

have maintained an acceptable nutritional level for a specified period. On-site and take-home programs appear to require at least a year to show such improvement, although it is achieved in individual instances in shorter periods. Most of these programs currently enroll beneficiaries for an indefinite duration and allow them to stay as long as they are in the preschool age group. Scarce resources could be more efficiently used if the well-nourished child were graduated from direct supplementation and then monitored with growth surveillance; if nutritional relapse were to occur, then supplementation could be resumed. Supplementation during the critical weaning period may serve as an "immunization" against malnutrition at that time and afterwards.

Rehabilitation centers, on the other hand, limit the stay of the child to a period ranging from a few days to about four months, depending on the type of center. The most common model (Fougere and King 1975) provides day care, education of the mother, and full feeding for one to four months to children who are taken home to sleep at night. This model relies on the availability of separate medical facilities.

Day care rehabilitation centers are usually not permanent because of the small radius they serve. In general, a satisfactory nutritional level can be achieved in four months using a local diet when the appropriate foodstuffs are available. (Beghin and Viteri 1973). Determining when to close such a center in a rural area and rotate the program to a new community depends on several criteria: complete disappearance of second- and third-degree malnutrition in the neighborhood, the occurrence of repeated admission of the same mother-child pairs, and successful training of all mothers in proper child-feeding practices (Research Corporation 1970).

F. Where Should the Feeding Site or Distribution Point Be Located?

A first criterion is to locate facilities where the nutrition problem is most severe. When possible, these locations should be pinpointed by means of a national nutritional status survey. In the absence of such a survey, a community survey of either weight or circumference measurements may be used to estimate malnutrition rates in depressed urban and rural areas. The results of the survey can also be used to determine which children are eligible for the program. When no service facilities exist in most disadvantaged areas, planners should look for alternative delivery methods such as workers or mobile teams who deliver food to the home or village congregation areas, or should construct new facilities.

The radius from which mothers can practically travel to a central point to collect food should be determined in the individual case, but it will generally not exceed about 8 kilometers (Bernstein and Kreysler 1972). The image of the site also will affect participation. The location should reflect prestige, unless a positive image hinders the most needy from attending; this may be the case in some societies in which favored locations may be out of bounds to the lower castes. It is advisable to borrow space in existing facilities rather than to build new ones both for the sake of economy and for the motivational incentive that the food can provide for participation in other services, such as health care or family planning. Health and day care centers and primary schools are commonly used. If teachers are required to run the programs, however, they must receive a salary bonus and special training. The following guidelines have been suggested for establishing the location of nutrition rehabilitation centers (Research Corporation 1970):

- Determine the frequency of malnutrition by weighing all children, and choose a community with a high prevalence of second- and third-degree malnutrition.

- Determine the availability of medical services. A nutrition rehabilitation center (NRC) should be located where health services exist and where it can share health facilities.

- Determine the availability of adequate financial resources for running the center.

- Assure that the center is accessible to concentrated population.

- Determine the community's economic potential. At least 75 percent of the community should be able to afford the least expensive diet being recommended through education at the center; the foods being recommended should be readily available.

- Determine the existence of other health and food production programs that the NRC could complement instead of duplicate.

- Identify and elicit the support of cooperative local leaders.

If few health centers exist, it is not necessary to restrict NRCs only to communities with such centers. There can be many more NRCs than health centers and thus greater outreach to the malnourished (Fougere and King 1975; Beghin 1970). Generally, they should not be located in hospitals, but rather based in the village. A take-home approach to rehabilitation also has advantages if the community can provide adequate surveillance and domiciliary treatment; for example, the recuperation can take place in the home rather than at the NRC, and local health workers can supervise via home visits. This approach reduces costs and the need for facilities, but it

increases the importance of mother education and follow-up visits in the home.

G. What Buildings, Kitchen Facilities, Other Equipment, and Environmental Surroundings Are Required?

Low-cost, simple structures and equipment are preferable to elaborate buildings and facilities. On-site and nutrition rehabilitation centers, however, should have access to potable water and lavatory facilities, which may consist of simple pit latrines. Drinking water may be boiled. This level of hygiene at the centers serves both to prevent infection and to educate mothers. All programs should have weighing scales and, if possible, height-measuring devices.

Kitchens, no matter how simple, should be arranged in a convenient functional layout that follows the logical sequence of tasks, from receiving and storage, to serving, to disposal of garbage. Appropriate hygiene procedures can be designed in light of available resources. Soap and clean rags are desirable.

Rehabilitation centers and on-site centers providing day care should facilitate the children's intellectual and physical development by providing simple toys and the opportunity to play games of a sort that the mother can continue with the child at home.

H. How Should the Logistics of the Program Be Organized and Controlled?

The logistics of supplementary feeding programs begin with procuring a dependable supply of food. To the extent possible, it is desirable to use various interchangeable foodstuffs to guarantee a continuous supply. The quality of food should also be stated in procurement contract specifications. When the food comes from farmers, working capital and storage capacity should make it possible to purchase at peak harvest periods. When supplies come from wholesalers and processors, purchase contracts guaranteeing the terms of delivery are advisable. When international donors supply the foods, recipient countries should negotiate multiyear quantity commitments to ensure supplies.

The amount of food procured is determined by projections of the number of recipients and the individual ration for the period. If shortfalls occur, either ration size or number of recipients must be temporarily reduced. It is advisable to make such decisions in consultation with the community in order to keep the confidence of the program participants.

The delivery of foods to the sites requires analysis of the type of transportation, the frequency of delivery, and the control of the flow. Preparation of the food will involve cooking or packaging or both. Quality control at this point must guarantee nutritional adequacy and food hygiene. Control over the actual feeding operation primarily concerns the size of the ration. A substantial amount of food remaining on the plates means that the quality is unacceptable to the participants or that the serving is too large, or both.

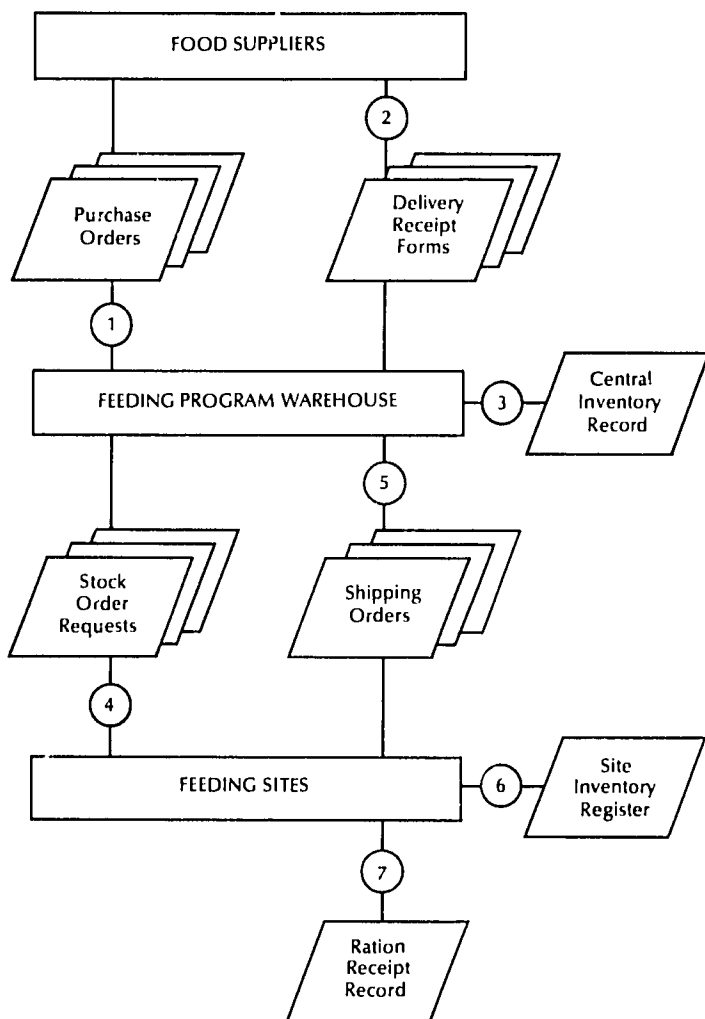
Inventory control must be exercised throughout the operation to ensure a dependable flow and to avoid spoilage. Figure 4.1 illustrates a logistics and document control system that could be used for the operation of a supplementary feeding program.

III. COSTS AND EFFECTIVENESS

Data on feeding program costs and nutritional impact are scarce. Furthermore, costs are not strictly comparable across countries, or perhaps even across regions within countries, due to differences in factor costs, exchange rates, and program design. Thus, caution is in order in interpreting the following program performance data.

The annual costs per child fed in take-home and on-site programs generally are in the range of \$10 to \$30, with food constituting about 50 to 90% of program costs (see Tables 4.3 and 4.4). NRCs are more expensive on a daily basis because they provide total feeding and often medical treatment. Daily costs range from \$.39 to \$1.86 and duration of stay from 28 to 192 days (see Table 4.5); on an annual basis the cost is about \$72 per child. NRCs cost about one-tenth as much as malnutrition recuperation units in hospitals (Beghin and Viteri 1973). Some countries have cut NRC costs considerably by reducing the time in the center and relying more on domiciliary treatment wherein the mother's role is increased and supplemented by village-level workers who visit the home periodically. Also, if one includes as beneficiaries the recuperated child's siblings, whose nutritional needs have been shown to be better met by the educated mother, cost per recipient decreases dramatically (Fougere and King 1975).

In analyzing program costs, one should attempt to relate them to nutritional effects. Thus, we are first interested in the cost of reaching the malnourished children, but because of selection procedures, not all program participants may be malnourished. Therefore, the cost per malnourished child will be higher than the cost per recipient to the extent that there are nonmalnourished recipients. The difference be-



Flow explanation:

1. Warehouse orders food from suppliers.
2. Food is delivered to central warehouse.
3. Receipt is recorded in central inventory record.
4. Feeding sites request food.
5. Food is shipped from central warehouse.
6. Receipt is recorded in site inventory register.
7. Ration is given to beneficiary and noted in ration receipt record.

Figure 4.1 Feeding program logistics and document control system.

Table 4.3 Feeding Program Cost Estimates

<i>Program Type</i>	<i>Annual Cost per Receipient</i>	<i>Nutrients Supplement</i>		<i>Cost per Nutrients</i>		<i>Food^a as % of Total Costs</i>
		<i>Protein</i>	<i>calories (g)</i>	<i>Per kg Protein</i>	<i>Per 100 Calories</i>	
<i>Take-Home</i>						
Mixed food distribution (Philippines)	\$12	22	456	\$1.08	\$0.07	94%
Milk distribution (Dominican Repub.)	\$10	12	121	\$2.12	\$0.23	85%
<i>On-Site</i>						
Special feeding centers (Colombia)	\$30	22	786	\$3.54	\$0.13	76%
Existing facilities (India)	\$ 8	12	300	\$2.03	\$0.10	76%
Feeding and nutrition education (India)	\$16	11	123	\$4.61	\$0.44	63%

Source: Adapted from Weil 1972.

^aIncluding freight costs.

Table 4.4 Cost per Child per Year of CARE Preschool Feeding Programs in Five Countries, 1976 (in U.S. dollars)

<i>Country</i>	<i>Total Cost per Child/yr.</i>	<i>Food</i>	<i>Distribution</i>	<i>Administration</i>	<i>Local Operating Expenses</i>
Colombia					
Take-home	24.75	13.41	2.01	4.56	4.77
Costa Rica					
On-site	94.54	70.58	—	2.46	21.50
Dominican Republic					
Dry take-home	13.55	10.34	0.72	1.42	1.07
Wet take-home	15.24	10.34	0.72	1.46	2.72
India (Tamil Nadu)					
On-site	14.46	10.69	0.21	0.69	2.87
Take-home	14.38	13.30	0.21	0.68	0.19
Pakistan					
Take-home	23.51	16.64	0.54	5.50	0.83

Table 4.5 NRC Costs

	Cost/Day/Child	Average Duration of Stay	Total Costs
Uganda ^a	\$1.86	42 days	\$ 78.12
India ^b	1.20	28 days	33.60
Haita ^c	0.39	192 days	74.88
Latin America ^d (6-country avg.)	0.89	120 days	106.80

^aSchneideman, Bennett, and Rutishauser 1971.

^bCutting 1975.

^cPyle 1977.

^dBeghin 1970.

tween these two represents the cost of overcoverage. An example of this cost is shown in Table 4.6, which lists the annual feeding program costs in four countries. As the table shows, the cost of overcoverage in selected CARE feeding programs ranged from \$22 to \$247 per year when weight deficiency was used as the selection criterion. If the difference is large, it might be justifiable to increase the administrative effort to select the participants more carefully according to nutritional need criteria.

This orientation should be extended further by relating costs to numbers of children who showed nutritional improvement. This can again be related to dietary or anthropometric indicators. Table 4.7 shows how the per capita cost increases as one relates cost to increases in dietary intake; for example, the daily program cost when divided by the total number of recipients was about \$.07 in Colombia (the most effective program), but the cost per capita rises to \$.47 when divided by the number of children for whom the supplement was sufficient to close their calorie gap entirely. Experience has shown that not all of the supplement results in an increment to the child's diet. Some supplement replaces food the child received previously (substitution) and some (in take-home programs) goes to other individuals (sharing). These leakages can be sizable, ranging from 40 percent to 70 percent of the rations; therefore, increased ration size and special education efforts become necessary. The on-site programs tend to have higher facility operating costs and substitution rates than take-home programs, and they are less able to feed large numbers of recipients; on the positive side, however, on-site programs encounter smaller leakages due to sharing of rations. Although leakages increase the cost per target group and may prevent sufficient quantities from reaching the most needy, they do represent an economic contribution to the family and thus have social utility.

Table 4.6 Annual Feeding Program Costs in Four Countries, CARE, 1976

	(1) <i>Annual Cost per Child</i>	(2) ^a <i>Per Child with Calorie Deficit</i>	(3) ^a <i>Per Child with Anthropomet- ric Deficiency</i>
Colombia			
Take-home	\$24.95	\$ 29.11	\$260.53
Dominican Republic			
Dry, take-home	13.55	14.89	66.10
Wet, take-home	15.24	16.75	74.34
Pakistan			
Take-home	23.51	28.67	45.39
Costa Rica			
On-site	94.54	112.21	290.00

^a(2) minus (1) = cost of overcoverage using dietary criteria; (3) minus (1) = cost of overcoverage using anthropometric criteria.

^aI.e., costs divided by number of children who were below normal compared to standard growth indicators.

Cost effectiveness can be further measured by the costs per child improved using anthropometric indicators, or even more correctly, per child improved relative to a control group. Table 4.8 shows how the cost per child rises as one applies these criteria.

A final note is applicable to all three types of feeding programs. The costs reported may make these interventions seem prohibitively expensive, especially when one begins to express them in such terms of cost as per malnourished child improved, per calorie gap closed, and per positive weight for height changes. If one compares these costs with per capita health budget costs, this impression will be especially reinforced. Such comparisons, however, fail to consider that central to the cost-effectiveness methodology is the concept of targeting. The nutrition programs should be reaching only the most vulnerable groups, i.e., children under thirty-six months old and pregnant and lactating women who are nutritionally deficient or clearly at risk (as indicated, for example, by low income or the presence of a malnourished child in the family).

The target group represents a relatively small percentage of the population. For example, based on income distribution and calorie elasticity data, about 48 percent of the populations in Africa, Asia, the Middle East, and Latin America suffer from daily calorie deficiencies greater than 250 calories (Reutlinger and Selowsky 1976). Children under three years of age constitute approximately 12 percent of the

Table 4.7 Cost-Effectiveness of CARE Preschool Feeding Programs in Five Countries, 1974 (in U.S. dollars per day)

	Colombia (Take-Home)	Costa Rica (On-Site)	Dominican Republic (Take Home)		India (On-Site)	Pakistan (Take-Home)
			Wet Daily	Dry Monthly (Combined)		
Per child total	0.068	0.328	0.042	0.037	0.050	0.064
(Percent eating ration day prior to interview)	50	79	51	47	84	18
Per 100 calorie net intake increase ^a	0.082	0.090	0.221	0.086	0.036	0.273
(Actual calorie increase)	165	462	37	92	160	131
Per closing average child's calorie gap (F.O 1360 cal/day requirement)	0.314	0.294	1.029	0.478	0.200	0.972
(Actual calorie gap)	382	327	465	557	549	356
Per gram protein ^a net intake increase	0.013	0.019	0.091	0.039	0.007	0.298
(Actual protein increase; in grams)	10.1	22.0	0.9	2.0	8.5	1.2
Per closing average child's protein gap (37 g/day requirement) ^b	0.147	0.114	1.083	0.558	0.088	2.742
(Actual protein gap in grams)	11.3	6.0	11.9	14.3	12.6	9.2
Per child improved ^c calorie gap closed	0.471	0.753	0.596	0.619	0.810	1.263
Protein gap closed	0.337	0.439	Gap not closed		13,924.98 0.566	18,314.29 0.460
(Actual % of total participants with no gap after eating ration)						
Calories	14	44	7	6	6	5
Protein	14	33		8	19	7

^aCost per calorie or protein net intake increase = (Total cost per day)/(Daily increased calories or protein % who ate)

Increased protein represents supplementary effect of ration on the usual home diet (without ration). Substitution for normal home diet has been taken into account.

^bThe cost of closing the protein gap (required) was calculated by multiplying the actual gap by cost per gram net protein intake increase. The cost (actually spent) equals the total daily cost of the current programs.

^cCost divided by percent of total program participants who had no calorie or protein gap after eating the ration.

Table 4.8 NRC Cost-Effectiveness Measures.

<i>Nutritional Improvement Criteria</i>	<i>Cost per Child</i>	
	<i>Haiti</i>	<i>Guatemala</i>
Receive services	\$ 72	\$ 214
Show positive weight for age change	103	301
Show weight for age change > control	605	2672
Decrease 3rd-degree PCM > control	3627	5344

Source: Adapted from Beaudry-Darisme and Latham (1973)

population in most developing countries, pregnant women constitute another 3 percent (three-fourths of annual births), and lactating women make up 2 percent (one-half of annual births). Thus, 17 percent of the population is biologically vulnerable; but only 48 percent of this group, or 8 percent of the population, is economically vulnerable to malnutrition. Thus, although per capita costs are high, the relatively small total number of target group individuals means that total costs of feeding interventions for target groups would not necessarily be excessively burdensome for developing-country budgets. Minimizing cost outlays is critical because of budgetary constraints, but maximizing effectiveness within those financial limits is even more important.

The literature on feeding program impact indicates that nutritional improvement is possible, and our examination suggests that even greater impact would be possible through improvements in intervention design. Tables 4.9 through 4.12 present the results from various countries. In addition, the overall nutritional status impact of the five programs examined in the case study in Special Study I showed the following:

Colombia was reaching a more chronically malnourished group than children in the community at large. In 45 percent of the centers, the programs seemed to have a positive impact on weight for height of the participating children.

Costa Rica was reaching more currently malnourished children than in the community at large, and there was a significant improvement in weight for age. A positive impact on weight for height appeared to be occurring in 50 percent of the centers.

The Dominican Republic was reaching a group of children whose malnutrition rates were approximately equal to those of the nonparticipants, except for the greater incidence of second- and third-degree malnutrition among newcomers to the program. There was a significant improvement in weight for height (acute malnutrition). Forty-

Table 4.9 Average Weight Gain and Rate of Growth of Preschool Children in Various Types of Feeding Programs

<i>Type of Feeding</i>	<i>Country</i>	<i>Authors</i>	<i>Age of Beneficiaries (mos.)</i>	<i>% of Daily Calorie Requirement in Ration^a</i>	<i>Duration of Participation (mos.)</i>	<i>Mean Weight^a Gain (kg)</i>	<i>Mean Program Weight Gain Greater than Control (kg)</i>	<i>Mean Growth Rate Compared to Standard (%)</i>
Nutrition reha-bilita-tion	Philippines	Asia Research Organization (1976)	6-60		3	1.0		38% (76% of the children gained at least 150% of standard)
	Latin America	Beghin and Viteri (1973)	12-84	100	3-4	1.0-1.8		
	Brazil	Federal University of Pernambuco (1972)	12-60	100	4-6	1.7 (94 g/week)		
	Haiti	Weil (1972)	12-48	100	4	1.9	0.9	(80% of the children gained in excess of the standard)
On-site	Thailand	Weil (1972)	24-60	25	12	0.6	0.6	
	India	Taylor et al. (1978)	0-36	66	24		0.4	
					36		0.7	

^aFor entire period of participation.

Table 4.10 Average Increase, in Percentage Points, of Standard Weight for Age of Preschool Children in Various Types of Feeding Programs

<i>Type of Feeding</i>	<i>Country</i>	<i>Authors</i>	<i>Age of Beneficiaries (mos.)</i>	<i>% of Daily Calorie Requirement in Ration^a</i>	<i>Duration of Participation (mos.)</i>	<i>Average Increase in Percentage Points of Standard Weight for Age.</i>
Nutrition rehabilitation	Brazil	Federal University of Pernambuco (1972)	12-23	100	4-6	3-8
			24-35			4-7
			36-47			5-6
			48-59			3-7
	Latin America	Beghin and Viteri (1973)	12-84	100	3-4	3-5
Take-home	Philippines	Asia Research Organization (1976)	6-11	66	3	7
			12-23			8
			24-60			4
	Lesotho	McKay et al. (1974)	0-60	33	>12	3
On-site	Philippines	Asia Research Organization (1976)	6-11	25	13-18	4
			12-23			6
			24-60			1
	India	Narangwal Rural Health Research Center (1974)	0-36	66	24 36	3 4.5
	India	Gopaldas et al. (1975)	6-36	25	12	4.4

^aFAO requirement for twelve-to forty-seven-month-old children is 1360 calories.

Table 4.11 Change in Gomez Classification of Weight for Age of Preschool Children in Various Types of Feeding Programs

Type of Feeding	Country	Authors	Age of Beneficiaries (mos.)	% of Daily Calorie Requirement in Ration ^a	Duration of Participation (mos.)	% Increase in:		% Reduction in:		
						Normal	1st Degree	2nd Degree	2nd/3rd Degree	3rd Degree
Nutrition rehabilitation	India	Venkataswamy, Kabir (1975)	12-60	66	3	250	250	15		52
	Brazil	Federal University of Pernambuco (1976)	12-59	100	4-6	300				50
	Haiti	Fougere (1972)	12-48	100	4	8 ^b				50 ^b
	Philippines	National Nutrition Program (1975)	6-60	66	3				67 ^b	50 ^b
On-site Take-home	Brazil	Gandra (1977)	24-84	33	12			75		
	India	Khare et al. (1976)	0-60	25	15					33
	Philippines	Asia Rearch Organization (1976)	6-60	25	13-18			11		43
	Uganda	Moffat (1973)	0-60		36					100
	Jamaica	Alderman et al. (1977)	0-60		12				40	
	Colombia	World Food Program (1974)	< 24	50	6	221			39	
			24-60			176			57	
			0-60			48-189				
			0-60		12					

^aFAO requirement for twelve- to forty-seven-month-old children is 1360 calories.

^bIn Haiti, the changes in Gomez classification were measured after the program had been in the community for seven years. In the Philippines, changes were measured after five years. Furthermore, in the Philippines second-degree malnutrition was reduced by 61 percent and third-degree by 63 percent in the control group, which means the program may have had an educational effect on the control community or that the improvement in program children is not due to the NRC program.

Table 4.12. Growth Progress of Preschool Children in Various Types of Feeding Programs

Type of Feeding	Country	Authors	Age of Beneficiaries (mos.)	% of Daily Calorie Requirement in Ration ^a	Duration of Participation (mos.)	Percent Who:			
						Improve ^b	Stay Same	Deteriorate	Die
Nutrition rehabilitation	Latin America	Beghin and Viteri (1973), Beghin (1976)	12-60	100	4	62-84			0-5.8
	Haiti	Fougere and King (1975), King et al. (1975)							
On-site	India	Venkataswamy and Kabir (1975)	12-60	100	1	32	64	4	
	Brazil	Gandra (1977)	24-84	33	12	43	55	2	
	India	Narangwal Rural Health Research Centre (1972)	0-36	66	30	55			
Take-home	India	Khare et al. (1976)	0-60	25	15	75			
	Ghana	CRS (1975)		33	> 12	21			
	Ethiopia	Habte (1973)			12	60	58	21	
	India	Gopaldas et al. (1975)	6-36	25	7	27	48	25	

^aFAO requirement for twelve- to forty-seven-month-old children is 1360 calories.

^bDemonstrate anthropometric gains attributable to the program.

five percent of the centers appeared to have a positive impact on weight for height.

India (Tamil Nadu) was reaching children with less chronic malnutrition (stunting) than the nonparticipants and less second-degree malnutrition. (It is not clear, however, to what extent participation in the program led to improved growth.) The program appeared to hold height for age and weight for age constant, but the rate of malnutrition by weight for height was higher among the long-time participants. Only 21 percent of the centers seemed to have a positive impact on weight for height.

Pakistan was reaching children with significantly less severe malnutrition than in the nonparticipant group, and less mild malnutrition as judged by less than 90 percent weight for height. (As in India, however, it is not clear to what extent participation led to improved growth.) The program appeared to be holding malnutrition rates on all measures constant. Forty-one percent of the centers showed positive impact on weight for height.

Although positive impact is attainable through supplementary feeding, one must recognize that this intervention may have negative aspects, such as increasing external dependence, creating a disincentive to agriculture (via food aid imports), and failing to affect underlying structural causes of malnutrition (Maxwell 1978). Thus, the importance of careful design is highlighted, as is the need to relate this intervention to other direct nutrition programs, such as education, as well as indirect interventions, such as health, sanitation, and income-generating projects.

Nutrition Education

Marian F. Zeitlin and Candelaria S. Formacion

I. DEFINITION AND RATIONALE

Nutrition education refers to any communications system that teaches people to make better use of available food resources. Most of the other approaches to nutrition intervention require an educational component. However, education may also be the primary form of intervention.

Because undernutrition of preschool children is the primary nutrition problem in developing countries, the nutrition education strategies presented here focus on changing the dietary practices that affect young children and pregnant and lactating mothers. Nutrition education is appropriate where these beliefs rather than absolute lack of food are the key constraint.

Doctors working with pediatric patients were the first to document the fact that malnutrition at the weaning age was a widespread problem in developing countries that could be often alleviated by education. International agencies have recognized the need for nutrition education since the 1950s. The global mail survey of nutrition projects conducted by Austin and coworkers (1978) found that more than 90 percent of nutrition education programs were combined with health services. However, nutrition education also falls within the domain of nonhealth disciplines and sectors such as formal and nonformal edu-

cation, community development, agriculture, social marketing, social work, psychology, communications, and the diffusion of innovation. Multidisciplinary approaches can greatly extend the reach of, and increase the effectiveness of, traditional health education. To explore further the perspectives presented in this section, readers may wish to consult Rogers and Shoemaker (1971), Drummond (1975), Herron (1977), and Srinivasan (1977).

Above a certain poverty threshold, most of the malnutrition associated with the weaning age results from feeding practices and not from absolute lack of food at the family level. A study by Sidney M. Cantor Associates (1973 Appendix 4-2) showed that in Tamil Nadu, India, even those families in which an average of 112 percent of individual calorie needs were met provided less than 80 percent of required calories to the twelve-month-old child. Levinson (1974) found in the rural Indian Punjab that 35.5 percent of infants in the highest income group consumed an average of less than 58 percent of daily caloric allowance and that 67.8 percent consumed an average of less than 75 percent. This is not an effort to "blame the victim"; poverty caused by the social and economic structures remains a fundamental cause. However, Special Study II (*Nutrition Education*) presents calculations estimating that families that can afford to reallocate about 5 percent of total family caloric intake to the youngest child can reverse or prevent serious malnutrition at the weaning age through behavioral changes resulting from nutrition education.

Below such an economic threshold, attempts to alleviate malnutrition through education without simultaneous increases in real income will not be successful. Nutrition educators find their goals subverted in situations where government policies lead to or maintain economic inequality, as pointed out by a report from a 1978 International Union of Nutrition Sciences (IUNS) workshop in Dar es Salaam (IUNS 1978). Part of their role as educators under such circumstances is to provide groups seeking broader social change with irrefutable statistics indicating the human costs in malnutrition and the immorality of policies that promote inequality.

The forms of nutrition education vary by target group and by communication channel. The outline below presents an inventory of the common target groups and of the channels used to reach them. The intervention design questions that follow will assist in the process of selecting the specific target audiences and the educational media most appropriate to individual situations.

1. *Mothers and other community members influencing eating patterns of vulnerable groups and family food production*

a. Nonformal face-to-face education

Combined with:

- health services
- family planning
- agricultural extension
- social welfare
- women's programs
- day care/preschool education programs
- community development
- youth programs
- political party activities
- religious organizations

Structure of face-to-face education in all the above contexts can be:

- group activities
- discussions
- demonstrations
- participatory learning
- one-to-one
- in center
- in home

b. Small media

(These are materials used and distributed by the educator; ideally, some of the same materials also should be distributed through mass channels, including commercial sales.)

Printed, or mimeographed materials

- posters
- hand-out sheets, leaflets
- calendars
- booklets
- comics, photonovels

Audiovisual materials

- tapes
- slides
- filmstrips
- videotapes

Community involvement materials

- photographs for stimulating discussion
- simple instruments for community self-assessment
- learning games

c. Mass media

- Radio and TV
- Cinema houses

Printed media

- d. Direct mail
- e. Adult education/literacy programs

2. *School children*

- a. Formal—in school
- b. Radio-TV
- c. Nonformal groups: 4H, extension, scouts, etc.

3. *Medical and agricultural professionals and paraprofessionals*

- a. Institutional instruction, requiring textbooks containing accurate information concerning malnutrition of the vulnerable groups
- b. Field experience, e.g., medical students being responsible for conducting malnutrition prevalence surveys (field manuals are required)
- c. Association meetings, seminars, symposia, workshops
- d. Direct mail, newsletters, professional journals, radio

4. *Food processors, distributors, and commercial advertisers*

- a. Association meetings, trade journals, newspapers
- b. Radio and television programs
- c. Incorporation of nutrition education into training programs

5. *Politicians, planners, and ministerial heads*

- a. Public relations and lobbying
- b. High-level meetings, seminars, and workshops
- c. Malnutrition ward or nutrition rehabilitation center placed visibly in nutrition institute or in prestigious hospital in capital city.
- d. Exposure to newspapers, radio and TV programs
- e. Dissemination of project activities and of results of malnutrition prevalence surveys in fact sheets, brochures, annual reports, news releases

II. KEY INTERVENTION DESIGN QUESTIONS

A. How Should the Program Diagnose Nutrition Education Problem Areas and Determine Project Goals?

Whether the initiative for nutrition education comes from the top of the planning level or from a grass-roots program, a task force for plan-

ing should include representatives of the groups at all vertical levels who will assist in implementing and evaluating the program. Ideally, a central nutrition education unit should coordinate planning activities. This could be part of a larger nutrition planning unit. Members of the target communities should be invited to participate because they know and have more control over certain important aspects of the problem than do outside specialists. Nutrition and child health authorities, market researchers, and other social scientists should take part in planning activities. Heads of institutions that train health, nutrition, and other extension workers should be involved in order to ensure that the educational activities developed by the program are incorporated into each training curriculum.

The task force should first collect and review existing studies concerning nutritional status, dietary practices, mortality, morbidity, and food production. If the project can afford a baseline survey, it should be conducted early in the planning stage so that results can be used for program design. If reliable baseline information is not available, the project should at a minimum conduct its own small survey, asking mothers for information about their own diets and those of their infants and/or young children during the last twenty-four hours (twenty-four hour recalls) and weighing the children.

The planning group should use the available information base to prepare a statement of program goals. They should also specify the nature of the problem, the target groups, and the number of each group to be reached during successive phases of the project. The statement of goals should specify in broad outlines the program's behavior change and nutritional status change objectives against the best baseline figures available. They should also specify the major channels for reaching each group.

B. How Should the Community Be Involved?

Low-income rural communities in India and Africa have proved capable of mobilizing local resources to cover up to 80 percent to 90 percent of the costs of village-level health and nutrition programs (Arole and Arole 1975; also see the case study concerning the Yako, Upper Volta, program in Study IV, *Formulated Foods*). Local financing makes it possible to extend services over wide areas without increasing government expenditure. Moreover, the effectiveness of these village-level services in reducing mortality appears to exceed that of standard paramedical care (see in this series Study VII, *Integrated Nutrition and Primary Health Care Programs*). Nutrition education, in particular, is most effectively delivered by community members because dietary change depends on cultural relevance and acceptance.

Methods of gaining community cooperation include both starting with a project with obvious visible benefits and also following a matching funds principle that requires communities to make local contributions in order to be eligible for assistance. Community involvement strategies of the sort used by Save the Children Federation (Sanghvi, undated) have proved successful in motivating community workers in nonnutrition fields to develop community-based nutrition education programs. Mature, married women who are residents of the community are particularly suited to advising mothers on weaning foods, breast feeding, birth spacing, and other nutrition education topics. The community should generally play a central role in selecting village-level workers; the workers' characteristics should vary according to the local social structure.

C. What Educational Strategies Promote Attitude and Behavior Change?

Change in dietary behavior follows a bell-shaped curve, like the adoption of other innovations. A minority of people changes soon after the new idea has been introduced, the majority changes after some time, and another minority changes very late or not at all. Cultural borrowing, new products and technology, urbanization, price shifts, commercial advertising, and nutrition and health education are among the factors that can influence dietary change. Public education campaigns have been found to have little success when they must compete with counterpropaganda, such as commercial advertising (Kotler and Zaltman 1971). This implies that the advertising of infant formula, for example, may have to be regulated before breast-feeding education can be expected to be successful.

Attitudes and behavior continuously interact (Kelman 1974). Nutrition education works to change both simultaneously, and it should make use of a number of principles that have been proved to promote the change process. Attitude and behavior change depend on the educator's effort and sensitivity to the client (Rogers and Shoemaker 1971) and on the credibility of the institutions and individuals providing the education (Hovland, Janis, and Kelley 1953). Consistent services and medical referral systems increase institutional credibility, while an authoritative image and cultural similarity to the learner group increase the individual teacher's credibility. Change is more likely if the educator is a good role model; in addition, people are likely to imitate the behavior of prestige figures, familiar figures, or favored figures. Motivation is important both for program participation and for behavior change. Motivating factors should include social approval, and appeals to the desire for big, healthy, and intelligent chil-

dren, for middle-class or modern status, and for community solidarity. Program services such as primary health care or food distribution should be structured in a manner that motivates attendance at nutrition education classes.

Teaching practices favoring change include enlisting community opinion leaders in the learner group, demonstrating new behavior, providing opportunities to the learners to practice this behavior with the teacher's guidance, and reinforcing correct practices. Using open-ended questions to introduce themes, encouraging discussion, eliciting public commitment before the group, and role playing also promote change. New behavior patterns also spread through diffusion from one member of the community to another (de Chavez, Gil, and de Regt 1972). The program can increase the diffusion process by encouraging the learners to teach the new procedures they have learned to their neighbors and by providing them with materials, such as illustrated fact sheets, to share with others. Repetition of the same themes and messages through different channels—such as in class, over radio, and on billboards—reinforces learning.

D. How Should Themes and Messages Be Designed?

The word "theme" refers to the information that is to be conveyed. The word "message" applies to each unit into which the theme is broken down and to the specific words used to express this unit. This distinction is most important in the case of the mass media, such as radio, where every word in a thirty-second spot must be carefully specified and recorded in advance of the broadcast. The face-to-face educator can take a theme and spontaneously translate it into specific messages to suit the circumstances of the individual or of the group. Individual messages can also evolve out of group discussion.

The biological requirements of infants are sufficiently similar throughout the world so that it has been possible to draw up a generalized list of priority themes for nutrition education affecting the preschool age group. The list presented in Table 5.1 has been adapted from a trainer's manual produced by the Nutrition Center of the Philippines (1976). A similar list was formulated in India by Greaves (1973). The words "high risk" or "low risk" in brackets are estimates of the negative or dangerous results that traditional mothers anticipate from a behavior change recommended by a theme.

In each culture area, this general list must be modified so that it addresses local behavioral problems. Most traditional cultures have recognized that health and diet are related. However, most also have a number of damaging feeding and child-care practices that contribute

Table 5.1. Priority Themes for Nutrition Education

A. Milk Feeding (Low Risk)

1. Mother's milk is best for the baby. Breast feed on demand, day and night, as long as is possible without great inconvenience.
2. If breast feeding is not possible, consult a trained health worker for the right feeding formula and for the hygienic methods of preparing the milk and feeding the baby.

B. Weaning Foods and Supplementary Feeding (High Risk)

3. Mother's milk or cow's milk alone is not sufficient after six months. Start feeding the baby with other foods at four to six months.
4. What foods should be given?
 - a. By six months, babies can eat almost any food that has been recently cooked all the way through and is mashed soft. They can also eat most uncooked fruits, recently peeled and mashed soft.
 - b. The baby's regular food can usually be the same as the parents' meal. Put the baby's portion in a separate cup or dish, mash the food soft, and feed it with a spoon. Oil or sugar may be mixed in for extra calories.
 - c. A multimix weaning food may also be specially prepared for the child.
 - d. Green leafy vegetables and high-protein foods such as beans, fish, or meat should be fed to the baby daily by six months, if possible. These can be mixed into the baby's regular food or fed separately.
 - e. When babies and young children refuse to eat peppered foods, the cooking method can be changed so that the pepper is added near the end of the cooking after the baby's meal has been removed.
5. How much and what kinds (quality) of food should be given? By nine months, the baby should have breast or cow's milk plus at least a half-cup of other food in the morning, at noon, and at night. This amount should increase from a half-cup to about one cup at every meal and snacks between meals by the age of one to two years. The one- to two-year-old should eat almost half as much as his mother.

C. Preschool Feeding (High Risk)

6. Satisfy the food needs of the infant and preschool child before those of the other family members.
7. Preschool children have small stomachs. Try to feed them five or six times per day. Make sure they have at least three meals per day. If possible, mix one teaspoon cooking oil, butter, or fat with each meal to provide more energy.
8. If cow's milk is available, give the preschool child at least one cup per day.

D. Care of the Sick Child (High Risk or Low Risk, Depending on Culture)

9. Don't stop feeding a sick baby or a baby with diarrhea. A sick child needs complete nourishment to make him strong in fighting infection. Continue to feed him with soft nutritious foods like eggs, milk, fish, beans, or vegetables and fruit. Never stop breast feeding a sick baby or a baby with diarrhea because mother's milk is the easiest food to digest.
 10. Diarrhea causes the body to lose too much water. Give fluids, such as a glucose electrolyte solution, to infants with diarrhea to prevent dehydration.
 11. Take a sick child for treatment early, before the condition becomes serious.
 12. If you are visiting a spiritual healer, let this person treat the spiritual side of the illness, but let the modern worker treat the body.
-

Table 5.1. Priority Themes for Nutrition Education (Continued)

- E. *Balanced Diet from All the Food Groups (Low Risk)*
13. Foods can be divided into groups or according to the functions they perform for the body. The three functions are energy yielding, body building, and protecting or regulating. These functions can be taught directly, or foods can be divided into three or four groups according to function. The new four-group system starts with the staple food as the first group, and teaches that the previous three groups are supplements to the staple, making a total of four.
 14. Everyone in the family needs foods for all the functions or from all the groups.
- F. *Pregnant and Nursing Mothers (High Risk or Low Risk, Depending on Culture)*
15. If you are a pregnant or a nursing mother, remember that you are eating for two people. If you are not too fat, try to eat more foods having all the functions or from all the food groups.
- G. *Family Planning (High Risk)*
16. Give adequate time and care to each child and restore your health by spacing children.
- H. *Food Production (Low Risk)*
17. Grow foods in the backyard and raise poultry, rabbits, or pigs, if possible. Expand the variety of foods you already produce.
- I. *Food Sanitation (High Risk or Low Risk)*
18. Wash your hands before cooking, before eating, and after using the toilet.
 19. Wash raw foods thoroughly before serving, or peel them.
 20. If you reheat a cooked dish to keep it from spoiling, make sure it boils again for at least 15 minutes in order to kill all the germs. Don't feed leftover foods to babies.
 21. Protect your foods from rats, flies, cockroaches, and other insects. If they come in contact with food, they transmit germs and disease.
- J. *Water (High Risk or Low Risk)*
22. Do not give water from streams or shallow wells to babies unless you boil it first.
- K. *Detection of Nutritional Status (Low Risk but Not Highly Credible)*
23. Big babies are usually healthier than small or thin babies.
 24. Big babies have a better chance of growing to be intelligent children and adults than small or thin babies have.
 25. Take any child with the following signs to a nutritionist or health worker:
 - a. very thin
 - b. loose skin folds in arms, thighs, and buttocks
 - c. prominent ribs, wing bones
 - d. swollen feet, face, or arms
 - e. paleness at lower eyelids, face, lips, and nailbeds
 - f. night blindness
 - g. sore at the corner of the mouth
 26. To know if your child is undernourished, have him weighed.
 27. To check on your child's progress, have him weighed every month, if possible, and record his weight on a growth chart.
-

Source: Adapted from Nutrition Center of the Philippines (1976).

to malnutrition and to high mortality rates at the weaning age. These negative behavior patterns may have been responses to environmental or social pressures.

A second phase of problem diagnosis is to identify the behavioral sequences that cause malnutrition and to develop acceptable alternatives. Table 5.2 summarizes the more common damaging beliefs and practices. Those who develop themes and messages must ask target group mothers and the health workers who serve them how infants are fed during the period from birth through weaning, and how illnesses are recognized and treated. They should also observe behavior and probe to find out whether the mothers follow the additional practices described in Table 5.2.

When culture-specific priority themes have been established, the themes should be broken down into action messages through formative evaluation. Formative evaluation is the small-scale evaluation and adjustment of each step in a new process in the formative stage, while the process is being established or created. In the case of a new weaning food recipe, for example, target-group mothers who will be using the recipe are asked to prepare it in their homes and to feed it to their infants. The investigators observe the preparation and feeding, discuss the practicality of each step with the mothers, and modify the recipe to make it satisfactory to the majority.

Different message content may be required for different segments of the population. Working mothers may have to learn to bottle feed hygienically, for example, while nonworking mothers should be discouraged from bottle feeding. Messages should be consistent within a given region in order to prevent confusion and to take advantage of media synergisms. In an isolated project, however, the process of message development may occur autonomously without reference to a broader context.

E. How Should Nonformal Nutrition Education Be Designed?

Since any educational activity that takes place outside a school or literacy classes is nonformal, the list of possibilities is extensive. Priority themes can be taught to groups, through individual counseling, in a center, in some natural outdoor meeting place, in the home, or in a nutrition rehabilitation unit. Nonformal nutrition education should play a role in a large variety of development activities.

Education should be scheduled at times when the learner group can participate without inconvenience. In Jamkhed, India, mobile teams came to the villages at dawn to provide health services and counseling before the women left for the fields (Arole and Arole 1975). Main em-

Table 5.2 Common Harmful Food and Health Beliefs

<i>Harmful Beliefs and Practices</i>	<i>Harmful Conditions Produced</i>	<i>Areas of World in Which Beliefs Occur</i>	<i>Relative Strength of Beliefs and Practices</i>	<i>Potentially Beneficial Functions of These Beliefs (Comments)</i>
<i>Breast feeding</i>				
Yellow colostrum (sometimes thought to be pus) is bad for baby. Mother's milk is not given until it turns white. (Cantor 1973: 2, 8; Mathur 1975)	Infection caused by feeding unsanitary substitutes. Caked breasts.	Very common but not universal	Strong	Spiritual bond formed with grandmother who gives alternate hand or spoon feeding, or neighborwoman who breast-feeds and her child who become milk brother, may be culturally important
Lactating mother's diet may be restricted to only bread and tea or some other unsatisfactory combination for period following delivery. (Wilson 1971; Cantor 1973: 2, 8)	Weakens mother and may affect quality and quantity of her milk	South India, Pakistan, Malaya, Latin America	?	Good food practices of giving chicken soup and other nourishing foods to the new mother are more common than these restrictions
Breast milk spoils & must not be given if child has not sucked at breast for 24 hours or more.	Enforces sudden, sometimes accidental weaning (if mother called away for some reason). Traumatic, can lead to marasmus.	Widespread; Nigeria, Camerouns, Russia	?	
Mother's milk will disagree with baby if mother is angry or upset. Mother should wait until she is calm to breast feed	Contributes to cycle leading to reduced milk supply and underfeeding of child.	Philippines, West Indies, Mexico	Weak to moderate	This belief may give lactation mother permission to create a calm environment for herself in which the letdown reflex functions well.
Evil eye commonly given by a jealous woman may cause mother's milk to spoil and be unfit for baby.	Abrupt weaning when infant's gastroenteritis is taken as a sign of spoiled milk caused by evil eye, malnutrition.	Subcontinent, West Africa	?	Sometimes influences mothers to prevent infants' exposure to strangers and crowds where child might catch infection.
Foods, such as chickpeas, cabbage, etc., may be avoided by lactating mother for fear of causing gas pains, etc., in nursing baby.	Mother's diet may become more deficient if food avoided is dietary staple such as chickpeas in Pakistan.	Almost universal. Foods avoided vary with region.	Weak	Individual infants apparently respond badly to these foods when eaten by some mothers, but such responses are uncommon.

Table 5.2 (Continued)

<i>Harmful Beliefs and Practices</i>	<i>Harmful Conditions Produced</i>	<i>Areas of World in Which Beliefs Occur</i>	<i>Relative Strength of Beliefs and Practices</i>	<i>Potentially Beneficial Functions of These Beliefs (Comments)</i>
Supplemental Feeding				
Breast of milk feeding is basically enough for baby until teeth come in or until it shows a desire to eat, or until end of first year of life or later. Other foods are given in insufficient quantities. (Rao and Balasubramanian 1966; Jelliffe 1968)	Most common cause of malnutrition	Underfeeding is universal, and also occurred in Europe and U.S.A. until turn of century or later.	Strong	Introduction of solids under unsanitary conditions often causes diarrhea, though infants receiving more solids—even under such conditions—still have been shown to have better survival rates.
Egg or egg yolk shouldn't be given before age 2 because it is a "hot" or "cold" food. (Ahmad and Zeitlin 1973; Cantor 1973)	Loss of protein source for infant when egg is available.	Areas where hot-cold beliefs are strong: Near East, Latin America, Indian Subcontinent	Very strong in some regions	Egg is an expensive food, and money could be used for less expensive protein and calorie source.
Eggs shouldn't be given to babies or children for fear that they will become thieves, will steal eggs, or won't learn to speak, or that their teeth will become yellow. (Jelliffe 1968)		Sub-Saharan Africa	Strong	
Meat and fish should not be given before age 2 either because they are too "hot" or because they will cause worms or stomach upset. Similar beliefs apply to beans, pulses, and oily foods in some areas	Loss of protein and calorie sources for infant when meat and fish or other foods are available	Nearly universal in one form or another	Vary from very strong to weak	Inadequate preservation of leftover meat and fish stews may make these dangerous for young children, particularly in hot weather. Beans do cause flatulence and perhaps some gastric distress.
Fruits—particularly lemons, oranges, and other citrus fruits—should not be given to infants because they are "cold" and may cause sore throat and cold. (Ahmed and Zeitlin 1973)	Loss of vitamins C and A	Some areas where hot-cold beliefs are strong	Vary from strong to weak	—
Infant shouldn't have highly peppered foods.	Child is limited to bulky staples, which are poor in protein and calories.	Some areas using lots of red pepper in cooking	Variable	Infants themselves often do not like the heavily peppered dishes and so may refuse them even when offered. This calls for a change in cooking habits.

Table 5.2 (Continued)

<i>Harmful Beliefs and Practices</i>	<i>Harmful Conditions Produced</i>	<i>Areas of World in Which Beliefs Occur</i>	<i>Relative Strength of Beliefs and Practices</i>	<i>Potentially Beneficial Functions of These Beliefs (Comments)</i>
For young infants, thin rice or other cereal gruel is given in place of breast milk when mother works.		Southeast Asia	Strong	
<i>Care of Sick Child</i>				
Foods and liquids are commonly withheld from sick infants, and particularly from children with diarrhea. Mothers' milk may be withheld. Cow's milk is almost invariably withheld. (Sanjur et al. 1970; Mathur 1975)	Dehydration during diarrhea is frequently most common single cause of death. Withholding foods leads to downhill spiral of malnutrition and lowered immune response.	Universal, with exceptions	Strong enough to be a serious cause of concern	
Diarrhea or stomach pains should be treated by purging or enemas to clear the gut. (Mathur 1975)	Worsens the condition.	Latin America, Subcontinent	Varying	—
Illness or malnutrition is caused by evil eye or witchcraft or other spiritual causes. (Kakar et al. 1972)	Magical treatments may be considered sufficient until child is so ill or malnourished that death or brain damage can't be avoided.	Universal	Strong in some areas	Illness also may have psychological causes, so treatment of spiritual healer may be valuable addition to modern medical and nutritional therapy.
<i>Pregnancy</i>				
Foods should be restricted so that infant doesn't grow too big.	Increased incidence of low-birth-weight infants	Common	Varying	
Foods such as meat, fish, egg, pulses, and some fruits and vegetables may cause bleeding or spontaneous abortion or other ills, anemia, or ill effects on baby. (Zeitlin 1973)	Loss of intake of available protein, low birth weight, loss of vitamins	Where hot-cold system is strong; other areas	Varying	—
<i>Family Food Distribution</i>				
The man or men in the family should get the best foods, and particularly the high-protein foods, while the children should be fed last. (Jelliffe 1968)	Malnutrition of the preschoolers and pregnant and lactating women	Almost universal	Strong	If the male household head falls ill, the entire family may be seriously jeopardized. If some individual must die, society loses the least by losing the youngest.

phasis should be on guided practice in cooking and feeding weaning foods, growth surveillance of infants, and other skills determined in the culture-specific list of priority themes. Teaching methods and clinical procedures that allow the learners to observe causal relationships are desirable. The Talquist hemoglobin test, for example, compares the color of a drop of the child's or the mother's blood with a color chart, so that the mother herself can see if the blood is not "strong" enough (Rosa 1964). Growth charts (World Health Organization 1978) are a major tool for teaching the effects of diet on child growth, and they may also be the most efficient form of health clinic record. Different types of growth charts may be used, depending on the community's technological skills. Weight charts are best for groups with literate community-level workers. Simplified circumference charts can be used by nonliterate village workers, or by the mother of the child (Zeitlin et al. in press; see Appendix A-8).

Where stories and proverbs are important forms of communication, they should be used to teach nutrition and health, as in Lardin Gabas, Nigeria, where all village-level workers teach health and nutrition themes in the form of stories (Christian Medical Commission, World Council of Churches 1977). Parables, riddles, songs, and drama also may communicate nutrition themes and may attract large crowds at folk festivals.

Short, intensive group courses can achieve rapid knowledge change. However, these courses must be delivered by workers with a high level of training and do not usually represent the best use of time and effort of intermediate-level personnel. To reach large numbers of mothers effectively, the intermediate-level workers should not be assigned to teach groups of mothers directly; rather, they should teach and supervise groups of community-level workers. In Yako, Upper Volta, for example, public health nurses meet monthly with groups of village-level nutrition monitors in central market villages within walking distance of the monitors' home neighborhoods. During this meeting, they teach and rehearse the demonstration lesson for the month. Each monitor returns to her village and "echoes" or repeats the demonstration lesson with the local mothers for whom she is responsible.

The same intermediate-level personnel preferably should also supervise one-to-one nutrition surveillance and counseling given by the community-level workers in their neighborhoods. One-to-one counseling also should be provided in health clinics and by other types of development workers, such as the agricultural extension agent, who detects a malnourished child.

Nutrition rehabilitation centers should be similar in almost every respect to the homes of the target group, so that new behavior

learned in the center can be transferred to the home environment. Innovations, such as latrine facilities (new for some groups) and packed earth platforms to raise the cooking fire beyond the reach of infants, for example, should be simple and cheap enough for mothers to afford at home. Caretakers at the center should be socially and culturally similar to the mothers. Foods used should be provided by the mothers themselves, or they should be foods that they can afford to continue to provide at home. The mothers should participate in the care and management of the centers, which should also be used as sites for training field workers in nutrition education. Mothers of rehabilitated children may themselves be trained to return home and conduct nutrition education and surveillance. Infants discharged from a center in the early stages of recovery should be placed under the surveillance of a neighborhood worker, who visits the home frequently during the first weeks.

Two special groups requiring nutrition education are day care attendants and vendors, who may prepare all or most of the meals eaten by some preschool children. Vendors can be taught to prepare and market improved weaning foods, as in Isoya, Nigeria (Isoya Rural Development Project 1976).

Although most nonformal nutrition education activities take place within health programs, other infrastructures should be encouraged to sponsor the same activities, as long as arrangements are made with health services for immunizations, deworming, and medical referral. When possible, nonformal nutrition education should be combined with other development activities in a program with multiple goals, so that successes of any aspect of the program can motivate continued effort in aspects that take longer to demonstrate results. In Gorom-gorom, Upper Volta, for example, community demonstration gardens provided a visible source of pride and satisfaction for program participants before the rehabilitation center had been in operation long enough to be functioning well.

F. How Should the Mass Media Be Used for Nutrition Education?

The term "mass media" embraces radio, television, signboards, posters, calendars, comics, photonovels, newspapers, magazines, booklets, leaflets, product labels, direct mail, audiovisual materials, and traditional communication forms such as dance troupes. Some material can be distributed through more than one channel: commercial sales outlets, health centers or workers, or direct mail. Similarly, a nutrition worker with a cassette recorder can play the same ten-minute program at the village well that can be broadcast over radio. Multimedia

approaches that combine face-to-face and mass channels are most appropriate for nutrition education not only because they create media synergisms but also because different channels are necessary for different phases in the learning process.

The logical phases involved in learning an entirely new skill or behavior, such as making bean curd from soybeans, are presented here, together with the channels that might be used for education (assuming that the members of the target group were not experienced in reading and following written recipes).

<i>Logical phases</i>	<i>Channels and materials</i>
1. Interest arousal	Radio spots, posters, distribution of free samples of bean curd (attractively prepared), with explanation by distributors
2. Initial broad instruction: the objective becomes a legitimate part of the public's agenda	Same as above
3. Motivation for trial: high payoff components	Radio spot (e.g., radio spot testimonials to health benefits for infants and whole family of eating bean curd)
4. Trial of practice	Nutritionist organizes demonstration at women's marketing collective, or women's club; members assist her. Demonstration announced by flyer or battery-powered megaphone or posters.
5. Repeated trial	Women's marketing collective has decided to try preparing and selling bean curd. Different members take responsibility for making it each day under the nutritionist's supervision. Children hand out coupons offering discount price. Posters and radio can reinforce this.
6. Adoption	Marketing collective decides to continue bean curd production., Radio spots continue to promote sales and legitimize the adoption.
7. Reinforcement	Nutritionist makes occasional visits to observe production. Newspaper writers feature story on collec-

tive producing and selling bean curd with photographs of members. This is framed and hung in collective kitchen. Visiting dignitaries are brought to see bean curd production unit. New series of radio spots promote use of bean curd in weaning food mixtures.

Some new practices—feeding fish from the family stew to six-month-old babies, for example—do not involve learning new skills. The mass media alone can encourage new behaviors for which the basic steps are familiar, without provision of face-to-face demonstrations and opportunities for practice. However, nearly a dozen experimental nutrition education mass media projects in the 1970s (Development Communications Report 1977) have reconfirmed the previous findings of communication researchers that face-to-face persuasion is required to convince people to try new behaviors that they perceive to involve a risk. Because of high infant mortality rates, and because mothers everywhere fear that new foods may give their infants severe forms of diarrhea (see case study to *Nutrition Education*, Study II; Yankauer 1975), changes in infant feeding and care are perceived to involve danger. For this reason, the priority themes listed in Table 5.1 are marked with a risk estimate to indicate the degree to which interpersonal persuasion may be required to teach them.

Radio generally is the mass medium with the widest penetration in rural areas of developing countries. In Iloilo in the Philippines, although only 47 percent of families owned radios, an evaluation survey found 75 percent to have heard nutrition education radio spots (Mannoff, Cooke, and Romweber 1977). Spot announcements—which can be in imaginative mini-drama format, as in the Iloilo campaign—can create message awareness in an entire listening population within a few months. Soap operas, comedy shows (Information Center on Instructional Technology 1976), and popular songs with nutrition themes (Allison 1977a) can also reach large audiences. Nutrition information programs, on the other hand, tend to reach only the well educated with a prior interest in nutrition; if the government controls broadcasting, however, listeners cannot turn to an alternate station that provides entertainment. Information programs remain an important means for educating opinion leaders and technical audiences such as field workers. Where broadcasting is controlled, radio doctor shows have proved popular and effective in reaching large audiences.

An initial seminar for field supervisors, combined with preprogram distribution of the broadcasting schedules of themes and messages to

nutrition field workers, is the simplest method of coordinating open radio broadcasting with face-to-face education. The packets sent to field workers should include an explanation of the rationale and the objectives of the messages and a list of problems or questions the field workers may encounter. It should also include some visual teaching materials, such as a flip chart that reinforces the radio messages, and an evaluation sheet that literate workers can mail back after each wave.

Radio schools, which combine listening with face-to-face program activities and correspondence, effectively reach special audiences, particularly when they offer incentives such as certificates for adults or prizes for school children. A program called "Hygiene Class" in Haiti has operated an annual contest for a target audience of up to 30,000 fifth- and sixth-grade students of ages 10 to 15. Prizes for high test scores sent to headquarters have included bicycles, watches, radios, and basketballs, as well as bonuses of equipment (Hollant 1978).

The radio forum is the village community discussion group that fills out questionnaire forms at the end of each listening and discussion session and sends these back to headquarters (Hall 1978). The forum decides what action will be implemented. The "Man Is Health" campaign in Tanzania, for example, mobilizes 37.5 million man-hours of labor to build latrines (Hall and Dodds 1974). Forums and other similar listening groups require political commitment and community organization.

Nutrition signboards and posters have high visibility in rural areas because of a general scarcity of visual materials. Small posters and calendars are often treasured in village homes (Church 1971). Comic books have been used effectively for nutrition education (Protein Foods Association of India 1972). Photonovels are potentially more effective than comics because of their greater realism, but they have not yet been used widely (Parlato, Parlato, and Cain 1977). Reading materials such as leaflets, booklets, and texts are important for the more educated segments of the population who act as opinion leaders, and for field workers. Newspaper articles and advertisements, direct mail, and product labels and package inserts also reach influential groups.

Audiovisual materials such as slides, films, and tapes can be effective (Aleta 1977). Field workers will not use these materials, however, unless they learn how in their training curriculum and their field program requires them to, and unless adequate arrangements are made for maintaining equipment.

Nutrition educators must take the initiative in claiming their share of public service resources with regard to radio, television, and the printed media (Manoff 1973a). Government production units or adver-

tising agencies with experience in social marketing may be enlisted to design nutrition education materials either free of charge or at cost. Song, drama, and art contests may also be held to develop materials. The nutrition organization should coordinate all aspects of the program and should involve field workers in formative evaluation, pretesting of materials, and monitoring radio broadcasts.

Themes to be communicated by radio spots and through pictorial materials must be carefully broken down into their component actions in order to fit within the limitations of the fifteen- to sixty-second time limits and the need for simple clarity of visual aids. A single theme can be presented in a series of spot broadcasts.

Rural villagers will reliably understand and remember simple or crude drawings or charts, but only if the meaning of the drawings has been thoroughly explained. Design factors that improve recognition and acceptance of visual aids by groups with little previous experience with pictures include *realism*, achieved by use of blockouts, or uncluttered photographs or realistic drawings; *familiarity* of objects, clothing styles, or of style of artistic presentation; *special care in picturing sequences*, so that each step has a separate illustration or frame, and each frame is numbered to indicate the order in which the sequence should be read; and *correct color association*. Posters and wall charts intended for adults should express their message in simple words in addition to pictures, so that school children or adults attending literacy classes can explain them to others.

All materials that will be mass produced or recorded for broadcasting should be pretested in a setting that resembles as closely as possible the conditions in which they will be used. Interviewers should take drafts of flip chart drawings, for example, into a village setting and ask mothers what they can recognize in the pictures, whether they like the presentation, and what they think of the themes and messages. Radio programs are tested by playing tape recordings of the planned broadcasts in target-group homes. Any source of misunderstanding or negative reactions should be changed before the final production.

G. How Should Nutrition Education Be Incorporated into Adult Literacy Programs?

Adult literacy programs sometimes reach large numbers of participants. In Pakistan in 1976, for example, it was calculated by Zeitlin, based on field observations and interviews with government officials, that nutrition education through the Maternal Child Health system reached 50,000 mothers, versus 700,000 persons (primarily women) reached by literacy activities. Most adult literacy students drop out

before reaching the stage of functional literacy (UNESCO 1976). For this reason, nutrition content must be included from the earliest stages of learning the alphabet. A program in Thailand (Harman and Vorapipatana 1971) does in fact combine nutrition education content with literacy activities from the first stages of instruction.

Booklets written for people with from third- to sixth-grade reading levels also are important for students who proceed beyond the basics, and for the great many primary school dropouts who retain a low level of functional literacy throughout life. A series of three booklets on nutrition and health written at an elementary reading level has been used for adult literacy classes and sold commercially (Zeitlin 1973).

H. How Should Nutrition Education Be Taught in the Schools?

Up to half of all children in developing countries enroll in elementary school (United Nations 1973); thus, nutrition education through the schools has wide potential coverage. The same visual materials produced for nonformal education of mothers may be used for teaching in the elementary school. Nutrition probably is best incorporated into other subjects such as health, agriculture, art, and arithmetic rather than taught in separate nutrition classes (Food and Agriculture Organization 1971). Schools should have a tape measure and scale so that children can record their own growth. Secondary school students also should learn about nutrition, although they represent an elite minority. Secondary schoolgirls, in particular, should learn the benefits of breast feeding. School lunch programs should contribute to nutrition education by involving children in growing foods for the school lunch and in planning and cooking the meals.

As in Bangladesh (Dillard 1976), schoolchildren may learn to detect malnutrition and to provide simple services in their communities. Or as in Isoya, Nigeria, schoolchildren may become involved in preparing nutrient-dense foods for their younger siblings (Isoya Rural Development Project 1976). Mothers may also come to the schools for services and for nonformal education (Stephenson et al. 1979).

I. How Should Nutrition Be Taught to Health Professionals and Other Extension Workers?

In some places, such as the Philippines, health professionals have been shown to be a source of nutritional misinformation, about breast feeding in particular (Burgess 1976). The emphasis of medical training in developing countries should be changed to reflect the impor-

tance of malnutrition as a public health problem. Realistic priorities are presented by Morley (1973a). Nutrition texts and other teaching materials for worker training at all levels and in a variety of disciplines are required. Texts prepared in one country may be adapted for use elsewhere. In addition, workshops and seminars should be held. Medical students and other health professional training program students should assist in the management and evaluation of ongoing field programs and should also receive instruction in a field setting.

Agricultural professionals in particular at all levels should be made sensitive to the possible consequences of diverting land for export of industrial crops at the expense of food production. They should perhaps emphasize protein-rich vegetable crops and should provide extension services to women as well as to men. Women frequently are responsible for growing the crops used in child feeding or for feeding their children from their own earnings. Professionals in other sectors—e.g., trade, industry, and tourism—should also be sensitized to how their activities impinge on nutritional well-being.

J. How Should the Policymakers Be Educated?

Although international and other assistance agencies have held a significant number of nutrition planning seminars for policymakers of developing countries, the majority of politicians and high-level planners are not yet aware of the seriousness of the malnutrition problem. Reasons for lack of awareness are that most malnutrition is not visible, and that the damage it causes, such as high infant mortality rates and low intellectual performance of low-income groups, may tend to be taken for granted. Nutritionists should continue to use a full range of public information approaches to educate policymakers. An effective method that is specific to nutrition is to open a rehabilitation center in a location in the capital city that is easily accessible to top policymakers and to invite opinion leaders of all levels to visit the center.

Before-and-after pictures of malnourished children have strong emotional and political appeal. Pictures of malnourished children have generated large sums of money for voluntary agencies from donors in industrialized countries. Such pictures, distributed in the form of posters requesting assistance, have proved useful to the Philippines National Nutrition Program.

The individual nutrition project should arrange meetings, including field visits, with policymakers interested in nutrition education and should, at the very least, have a single-page program description or simple brochure for distribution. At least one project paper, technical report, or annual report should be available to provide back-up infor-

mation. News releases announcing all project events should be sent to the local newspapers.

III. COSTS AND EFFECTIVENESS

Most of the evidence that nutrition education is effective in improving nutritional status is indirect because the impact of nutrition education is difficult to separate from that of other services, and from health care in particular. However, in several cases in which significant nutritional improvement of preschoolers has occurred and has been maintained without increases in real income, nutrition education does appear to be the cause. The eight-year-old program in Yako, Upper Volta (see case study in Study IV, *Formulated Foods*) has reduced the incidence of severe malnutrition to 0.2 percent in 1977 as detected by vaccination teams in a rural area in which there was no indication of general socioeconomic development. National prevalence estimates range from 3 percent to 15 percent. Ninety-four percent of mothers of six- to twenty-four-month-old infants in three Yako villages surveyed by the writer were able to give correct recipes for a weaning food taught by the program, and 60 percent had prepared this food for their children during the twenty-four hours preceding the survey. The cost to the central government of the community-level worker program was \$0.05 per recipient mother per year.

A study of Ghanaian preschool clinics, presented in Study VII, *Integrated Nutrition and Primary Health Care Programs*, found two nutritional knowledge variables to be highly correlated with weight for age of six- to twenty-four-month-old infants, after the effect of socioeconomic factors and other program inputs were controlled for by statistical methods. The cost of the educational component per recipient per year was estimated at \$2.80.

In Papua, New Guinea, relatively high-cost MCH services have succeeded in significantly improving the nutritional status of preschoolers over the past twenty years at the same time that food availability has declined dramatically because of the introduction of cash crops (Lambert 1975). Papua health authorities attribute this improvement to weaning practices taught by the health services. In view of the drop in food production, it appears unlikely that health care alone, without deliberate redistribution of family foods favoring the weanling child, could have brought about an increase in nutritional status. Average weights of children between the ages of birth and five years increased by about 1 kg from 1956 to 1975. Per capita daily caloric intake for adults dropped by about 800 kcal over this period as

measured by surveys taken at the "time hungry" before the harvest. However, caloric intake of one- to two-year-old children increased from 730 to 830 kcal (Lambert 1975). Aitken (1978) estimated the cost per child per year of the MCH program at \$12 to \$15. Additional data from a sample of 19,497 MCH attenders from the same Eastern Highland Province districts sampled in 1975 showed a further total decrease in percentage of under-five-year-olds falling below 80 percent of weight for age, from 27 percent to 17 percent (Lambert 1975).

In the Philippines, mean weight for age of graduates of mothercraft on-site feeding programs remained steady at about 80 percent (higher than the national average) in the four years following their participation in the program (Asia Research Organization 1976). Since there is no reason to believe that the socioeconomic status of these initially malnourished children improved, it is probable that the nutritional practices taught by the program maintained their better-than-average status. Similarly, the finding that younger siblings of children rehabilitated in Haiti had a lower-than-expected incidence of severe malnutrition (Webb, Fougere, and Papillon 1975) implies that mothers used the weaning practices they had learned at the rehabilitation centers with their subsequent infants. Costs of the Haiti program were estimated at \$6.82 per child protected (King et al. 1975).

A mass media nutrition education campaign in rural Iloilo in the Philippines (see case study of Study II) showed that the nutritional status of the 99 nine- to fifteen-month-old infants studied was positively correlated with two factors. One was the number of health and nutrition programs to which the infants were exposed, and the other was a test of their mothers' nutritional knowledge, after controlling for the effects of socioeconomic factors. Infants whose mothers had participated in either no programs or one program only were found to average close to the borderline of second-degree malnutrition. However, those having contact with two or more programs averaged low normal in weight for age, with a difference of about five percentage points between the two group means. The partial correlation between the mother's nutritional knowledge score and the weight for age of her infant, after controlling for her education, income, and her own and her husband's occupations, was significant at the .004 level. The nutritional knowledge score was correlated with the simplified measure of program participation at the .1 level. (The question concerning program participation did not investigate regularity of attendance, however.)

Although none of the existing evaluations of the effectiveness of nutrition education is unflawed, all the evidence tends to point in the same direction: well-managed nutrition education programs can, at a

relatively low cost, bring about behavior changes that contribute to improved nutritional well-being. Moreover, for policy purposes, it is possible to generalize and conclude that the following major design characteristics favor cost effectiveness: (1) absence of commercial promotion that contradicts nutrition education themes; (2) community-level programs; (3) combination of face-to-face and mass media channels; and (4) education of all the vertical levels involved in nutrition policy and implementation.

Fortification

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I. DEFINITION AND RATIONALE

Fortification is defined as "the process whereby nutrients are added to foods to maintain or improve the quality of the diet of a group, a community or a population" (Food and Agriculture Organization/World Health Organization 1971). Fortification assumes that existing diets are deficient in certain nutrients and that, by adding them, the nutritional problem can be alleviated. The major appeal of this kind of intervention is that additional nutrients (fortificants) can be incorporated into existing diets without major changes in consumption behavior.

The elimination of deficiencies would also probably occur with increased incomes, which provide the basis for more varied and greater food intake. However, fortification can be carried out more quickly than changes in income can be brought about. It is not a surrogate for development measures aimed at increasing the incomes of poor consumers. Even in the more developed nations, many foods are fortified.

Deficiencies of the following principal micronutrients have been addressed through fortification: iodine (which causes goiter, cretinism, and deaf mutism), vitamin A (which causes sight impairment or blindness), and iron or folic acid (which causes anemia). Defi-

ciencies of the principal B vitamins (thiamin, riboflavin, and niacin) have also been addressed in some countries through fortification. Other micronutrient deficiencies exist, but they appear less serious than the foregoing. Macronutrient fortificants include calorie-dense oil and synthetic amino acids or protein concentrates, which improve amino acid balance and increase available protein. Various foods have been used as the carriers of these fortificants. Iodization of salt is the most prevalent, and has been the most successful, fortification. Evaluations are in progress of vitamin A-fortified sugar in Central America. Vitamin A has also been used to fortify monosodium glutamate (MSG) on a pilot basis in the Philippines. In both instances, positive impact on serum levels of vitamin A appear possible. Iron fortification of wheat products has been carried out in several countries as has the fortification of dairy products with vitamins A and D. Clear documentation of their impact is not available. Protein fortification of wheat, rice, and maize have been undertaken on a pilot project basis in Tunisia, Thailand, and Guatemala, but the biological impact was negligible or uncertain.

The provision of mass dosages of the nutrients is often proposed as an alternative to fortification; therefore, this will also be briefly discussed in this section, along with other alternatives such as genetic breeding and home gardens.

II. KEY INTERVENTION DESIGN QUESTIONS

The key design questions for fortification are concerned with the following: nutrient needs, fortificant quantity, carrier selection, and alternative interventions.

A. How Should the Nutrient Needs Be Identified?

The starting point in designing the fortification intervention is the identification of the type and extent of nutritional deficiencies affecting different groups. Biochemical tests and clinical signs can be used to identify micronutrient deficiencies. Anthropometric measures can detect protein-calorie malnutrition (PCM). Dietary surveys are needed to ascertain the magnitude of any deficits. This assessment in turn is the basis for determining the quantity of the fortifier. Dietary surveys have the additional advantage of revealing subclinical deficiencies.

There are three special considerations in identifying the need:

Regional differences—intake and deficit levels can vary markedly across regions or between rural and urban areas, so the survey data must be in a geographically specific form rather than in the form of national averages.

Seasonality—intake can also vary significantly by season, leading to the need for periodic, rather than continuous, fortification. Thus, surveys should cover more than one season.

Nutritional interrelationships—all the nutrient deficiencies should be examined because of the biological interrelationships. For example, vitamin A may have little impact in the face of significant protein deficiency. Similarly, adequate caloric intake may well be a precondition to seeing positive impact of lysine fortification (Vaghafi et al. 1974). If multiple deficiencies exist, multivitamin fortification might be feasible.

B. How Much Fortificant Should Be Used?

The quantity of fortifier can be calculated as follows:

$$\text{Recommended daily allowance (RDA)} - \text{actual intake} = \text{deficit}$$

This simple formula is complicated by the fact that different afflicted groups have different RDAs and intakes, and hence different deficits. Thus, a standard fortificant quantity could be greater than some individuals' deficits and less than others. For administrative simplicity, however, a standard quantity of fortificant per unit of carrier is needed. One approach is to use as a standard the greatest known deficit quantity with the goal of helping the most afflicted group. This will mean that the program will incur excess fortificant costs, i.e., the cost of giving more fortificant than is nutritionally necessary to some individuals. Also, care must be taken to ensure that such amounts would not be toxic for those whose diet already includes some quantity of the nutrient.

The other variable that enters into the computation is the amount of carrier that the designated target group consumes. If individuals in one area consume twice as much as those in another area, either the fortificant has to be halved in the first instance or excess coverage accepted. Finally, the quantity of the nutrient must be increased to compensate for any losses incurred during processing, storage, or cooling.

C. What Factors Should Be Considered in Selecting the Carrier for the Fortificant?

1. Usage and Acceptability: The carrier should be widely consumed on a regular basis by the target group. This generally means that the carrier will be a food such as sugar, salt, MSG, or cereals.

Fortification generally does not adversely affect the sensory characteristics of the carrier, but systematic acceptability trials should be carried out (Bauernfeind 1973). The effect of fortification on cooking procedures, storability, and cultural norms should also be examined.

2. Commodity System Structure: The structure of the carrier's system (production, processing, distribution, and consumption stages) should be examined to ascertain where, how, and if the target group participates. For example, some families may not acquire the carrier, but rather grow their own and process it in their homes. These individuals may be precisely the most deficient ones and would not be reached by the fortification.

Conventional wisdom about fortification has asserted that feasibility requires that the carrier be centrally processed. This reduces supervisory, logistical, and control problems. However, it may also mean that the fortified staple would be widely distributed and consumed by non-needy segments of the society. A decentralized, regional, or village fortification program can be targeted more accurately to those in need. This is especially desirable where large regional differences exist. Greater control and logistical costs will be incurred, but excess coverage will be lower. Pilot projects in Guatemala and Thailand suggest that village-level fortification of cereals may be feasible (Austin 1977, 1979).

3. Technological constraints: The technological considerations are concerned with the fortificants and the fortifying process. In practice, neither present major constraints. Relevant aspects of the various fortificants follow:

Vitamin A

- is commercially available as acetate and palmitate esters marketed in oil solutions, water emulsions, and dry encapsulated beadlets;
- is practically insoluble in water;
- generally has no adverse effects on processing and organoleptic characteristics of carrier, but may affect color;

- is sensitive to oxidizing agents, ultraviolet light, and high temperatures;
- losses can be reduced with antioxidants and protective coatings.

Iron

- is poorly absorbed from diet rich in carbohydrates, phosphates, oxalates and carbonates;
- biological availability generally parallels solubility;
- reduced iron is most commonly used but has less than 50 percent of biological availability of ferrous sulfate or ferrous fumarate;
- ferrous sulfate is low in cost and has low bulk density, but presents stability problems when added to wheat and stored for long periods.

Iodization

- sodium or potassium iodide iodate is used;
- is inexpensive.

Calcium

- calcium carbonate is used;
- is inexpensive.

Protein

- L-lysine is most limiting amino acid in all cereals;
- L-tryptophan and L-threonine is limiting in corn and rice;
- fortificants can be synthetic amino acids or natural protein supplements like soy, fish protein concentrate, groundnuts, or single cell proteins.

In addition, the following technical considerations should be reviewed.

The availability of reliable, yet technologically appropriate, equipment is critical.

The process should ensure uniform distribution of the added nutrient in the carrier.

Quality control and monitoring using a rapid and reliable assay for an indicator nutrient is essential.

The effects on the quality of the added nutrients of processing, transport, and storage must be documented.

D. What Alternatives to Fortification Should Be Considered?

The most common alternatives to fortification are mass doses of micro-nutrients (either injected or administered orally), family gardens, nu-

trition education, and plant breeding. Mass doses should be administered to severely deficient individuals irrespective of the presence of a fortification program. Family gardens can focus on producing foodstuffs that contain high levels of the micronutrients in which people are found deficient. Nutrition education can help families make better use of existing foodstuffs so as to alleviate specific deficiencies. Plant breeding improves the quality of the common foodstuffs genetically.

These four programs are not necessarily mutually exclusive; however, mass dosage is often presented as an alternative to fortification. The strengths and weaknesses of a mass dose program—for example, to remedy vitamin A deficiency—are shown in Table 6.1. (A broader comparison of all the interventions is summarized subsequently in Table 6.7).

III. COSTS AND EFFECTIVENESS

The cost and impact data for fortification interventions are limited in quantity and quality. However, sufficient data exist to suggest that microfortification can be economically feasible and nutritionally effective.

A. Costs

The main incremental cost items for a fortification program are the following:

- Fortificant (price \times quantity)
- Labor (to add and handle fortificant)
- Control and evaluation (largely personnel)
- Equipment
- Logistics

The principal cost is the fortificant; Tables 6.2 through 6.5 show prices of individual nutrients. The total cost would depend on the quantity used (see previous section). The cost of personnel would be site-specific. Equipment costs for blending vitamins or mineral premix vary depending on capacity. For example, a ribbon mixer with a 5-cubic-foot, 68-kilogram capacity cost \$8500 in 1977; one with a 260-cubic-foot, 3536-kilogram capacity cost \$45,000. Village-level equipment costs are \$15 for premix or \$50 to \$100 for tablets or pellets.

Other costs, such as distributing the fortified carrier, should be considered only if they are incremental. For example, costs incurred in

Table 6.1 Strengths and Weaknesses of Mass Dosage

<i>Strengths</i>	<i>Weaknesses</i>
Body can store fat soluble vitamins	Biological availability can be low
Intervention needed only 2 or 3 times per year	Individuals missing dosage must wait long period
Deficiency can often be rectified	Existing health infrastructure may have inadequate coverage
Politically visible	Negative transitory reactions to dose
Can use existing health personnel	High dropout rates
	Need to finance and organize periodic campaigns

Table 6.2 1977 Prices of Vitamin A and Iodine

	<i>\$/kg</i>
<i>Vitamin A</i>	
Palmitate beadlet (250,000 IU/g)	15.00
Palmitate in oil (10 ⁶ IU/g)	30.00
Acetate beadlet (500,000 IU/g)	23.00
<i>Iodine</i>	
Potassium iodate	7.65

Source: Adapted from figures provided by Hoffman-La Roche (1977).

Table 6.3 1976 Prices of Commercially Available Iron Sources

<i>Iron Source</i>	<i>Cost per kg (U.S. \$)</i>	<i>Percentage of Contained Iron</i>	<i>Cost per kg iron (U.S. \$)^a</i>
Ferrous sulfate, dried	0.66	32.1	2.05
Ferrous sulfate, heptahydrate	0.84	20.1	4.16
Chemically reduced iron	1.56	96.0	1.63
Electrolytically reduced iron	2.55	97.0	2.64
Ferrous fumarate	2.24	32.9	6.82
Ferric orthophosphate	1.63	28.6	5.70
Sodium iron pyrophosphate	1.80	14.5	12.45

Source: Adapted from Davidson and Russo (1976).

^aAn even more useful cost figure would be the cost per amount of iron biologically available.

Table 6.4 Prices of Synthetic Amino Acids for Cereal Fortification, 1972–1977

	<i>L-Lysine · HCl</i>	<i>L-Threonine (U.S. \$/kg)</i>	<i>L-Tryptophan</i>	<i>D-L-Methionine</i>
1972	3.80	—	—	4.20
1973	3.80	—	—	4.20
1974	7.30	57.70	86.80	4.20
1975	5.60	57.70	86.80	5.30
1976	5.60	57.70	86.80	5.30
1977	5.60	57.70	86.80	5.30

Source: Adapted from Austin (1977).

Note: Prices are quoted for food-grade L-lysine and D-L-methionine in bulk quantities (a ton or more); for L-tryptophan and L-threonine, prices are quoted for pharmaceutical grade in quantities greater than 50 kilograms. Except for D-L-methionine prices, which are obtained from *Chemical Marketing Reporter*, amino acid FOB Japan prices are estimated from the "delivered prices" given by Ajinomoto Co., U.S.A., using the following formula:

$$\text{estimated price} = \frac{\text{delivered price}}{(100 \text{ percent} + \text{handling and transportation charge and customs duty})}$$

where customs duty is 6 percent for L-lysine HCL and L-threonine and 12.5 percent for L-tryptophan, and where the transportation and handling charge is estimated at 6 percent.

distributing the fortified product should not be charged to the intervention if they were previously incurred to distribute the unfortified product.

The following are approximate costs for various types of fortification; unfortunately, the studies from which these data are drawn do not provide a common cost basis for comparison.

Vitamin A fortification of sugar in Guatemala would cost \$2.20 per year to move each child with inadequate blood serum levels to adequacy at 20 mcg/100 ml (Arroyave, Aguilar, and Portela, n.d.). Vitamin A fortification of MSG in the Philippines cost \$1.64 per year, per child showing improved blood serum levels (Solon et al. 1979).

Iodization of salt costs \$0.002 per capita, with the cost per deficient individual about \$0.008 (World Food Council 1977).

Iron fortification would cost about \$0.11 per anemic person in Latin America.

Protein fortification (using synthetic amino acids or natural protein concentrates) of cereal grains would cost around \$2.50 per individual reached, unless the fortificant—e.g., soy flour—costs the same as the flour it displaces (Austin 1977).

Table 6.5 1977 Prices and Nutritive Value of Different Protein Sources

<i>Protein source</i>	<i>Percentage of Protein^a</i>	<i>Percentage of L-Lysine^b</i>	<i>U.S. \$/kg</i>	<i>Protein (U.S. \$/kg)</i>	<i>L-Lysine (U.S. \$/kg)</i>	<i>P.E.R.</i>
Spray-dried whole milk	26.4	2.3	1.89	7.14	82.17	3
Spray-dried skim milk	35.9	3.1	1.35	3.75	43.55	3
Defatted soy flour	50	3.6	0.35	0.70	9.72	2-2.5
Soy protein concentrate	70	4.2	0.77	1.10	18.33	2-2.5
Soy protein isolate	95	5.7	1.46	1.54	25.61	1.1-1.6
Fish protein concentrate	80	7.2	1.50	1.88	20.83	3
Full-fat soy flour	42	3	0.40	0.95	13.33	2-2.5

Source: Adapted from Austin (1977).

^aPercentage of protein values are obtained from the manufacturers.

^bPercentage of L-lysine values are obtained from Jansen and Ehle (1965a), Wolf and Cowan (1971), and Astra Nutrition U.S.A., Inc.

Note: Prices of milk products and soy products are FOB bulk rates quoted by Borden, Inc., and Central Soya, respectively. Price for fish protein concentrate is estimated from FOB Sweden prices quoted by Astra Nutrition U.S.A., Inc., for bulk quantities at \$0.235 = 1 Swedish krona. Price of full-fate soy flour quoted by ADM, Borden, Inc., Decatur, Illinois.

Table 6.6 Fortificant Quantities and Costs for Cereal Fortification

Country	Nutrient	Quantity per kg of Grain	Nutrient (\$/kg)	Grain (\$/kg)
Guatemala ^a	Thiamine	21.4 mg	25.00	0.000535
	Riboflavin	13.0 mg	42.00	0.000546
	Niacin	154.4 mg	5.00	0.000772
	Vitamin A	6,250 IU	30.00	0.0001875
	Iron	480 mg	5.70	0.002736
	Soy flour	78 g	0.35	0.0273
	L-Lysine-HCl	1.2 g	5.60	0.00672
				0.0386277
Tunisia ^b	Thiamine	8.5 mg	25.00	0.00021
	Riboflavin	5.4 mg	42.00	0.00023
	Niacin	63.8 mg	5.00	0.00032
	Vitamin A	10,000 IU	30.00	0.00003
	Vitamin D ₂	2,000 IU	30.00	0.000006
	Iron	55.9 mg	2.05	0.00011
	Tricalcium phosphate	50.0 mg	2.04	0.0001
	L-Lysine HCl	2.0 g	5.60	0.0112
				0.012206
Thailand ^c	Thiamine	5 mg	25.00	0.000125
	Riboflavin	4 mg	42.00	0.000168
	Vitamin A	23,700 IU	30.00	0.00007
	Iron	80 mg	2.05	0.000164
	L-Lysine	2 g	5.60	0.0112
	L-Threonine	1 g	57.70	0.0577
				0.069427

^aSource: Personal communication with J. J. Urrutia.

^bSource: Personal communication with G. Kerr.

^cSource: Personal communication with S. Gershoff.

Table 6.6 shows the cost of fortifying maize, wheat, and rice with minerals, vitamins, and protein.

B. Effectiveness

The effectiveness of fortification programs has varied, but the following results point to significant impact potential:

Vitamin A fortification of sugar in Guatemala resulted in shifts in the distribution curve of serum vitamin A to higher levels.

Vitamin A fortification of MSG in the Philippines increased mean serum vitamin A levels from 21.0 mcg per 100 ml to 28.5 with the

very deficient (below 10 mcg) quadrupling their average level; the 4.2 percent of the children showing active clinical signs of xerophthalmia were reduced to 1.0 percent after fortification (Solon et al. 1977).

Iodization of salt reduced the incidence of goiter in children in Himachal Pradesh, India from 38 percent in 1956 to 3 percent in 1973 (Bauernfeind 1973); in most of Central America goiter was largely eradicated due to iodization.

Iron supplementation in anemic laborers in Western Java resulted in increased hemoglobin and hematocrit levels and iron stores; morbidity decreased and productivity increased (Basta 1979).

Lysine fortification of cereal grains in Guatemala, Tunisia, and Thailand failed to produce positive growth benefits, perhaps due to the presence of caloric inadequacy (Austin 1977).

Planners should compare the costs, feasibility, and effectiveness of fortification with alternative interventions. Table 6.7 provides a set of criteria and proximate rankings of fortification, tablets, and injections, nutrition education, home gardens, and plant breeding. Study III of this series (*Fortification*) provides a more complete comparison of these interventions. Again, note that these are not mutually exclusive alternatives.

Table 6.7 Comparison of Alternate Interventions

<i>Criteria</i>	<i>Fortification</i>	<i>Oral Dose</i>	<i>Injections</i>	<i>Nutrition Education</i>	<i>Home Gardens</i>	<i>Plant Breeding</i>
<i>Costs</i>						
Initial capital investments	moderate	low	low	low	moderate	high
Continuing personnel	low	high	high	high	low	high
Continuing materials	low ^a	low	moderate	low	moderate	high
<i>Personnel Requirements</i>						
Skill level	moderate	moderate	high	low	moderate	high
Numbers	low	high	high	moderate	high	low
<i>Administrative Requirements</i>						
Supervision	moderate	high	high	moderate	moderate	high
Health system organization	low	high	high	moderate	low	low
<i>Technical Feasibility</i>						
Technology dependability	high ^b	high	moderate	moderate	high	moderate
Side-effects risk	low	moderate	high	low	low	moderate
<i>Beneficiary Role</i>						
Acceptability	high	moderate	moderate	moderate	moderate	moderate
Community involvement	low ^c	moderate	moderate	high	high	low
<i>Impact</i>						
Population coverage	high	moderate ^d	moderate ^d	moderate	moderate	moderate
Time needed to show benefit	moderate	low	low	moderate	low	high
Permanency of benefit	high	low	low	moderate	high	high

Source: Adapted from World Food Council (1977).

^aAn exception is protein fortification, which is expensive relative to micronutrient fortification.

^bIron fortification has encountered technical difficulties, but recent improvements appear to have resolved these.

^cDirect-dosage coverage is a function of the outreach capacity of the delivery system, but coverage is constrained by the one-to-one system.

Formulated Foods

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I. DEFINITION AND RATIONALE

The term "formulated foods" as used in this book refers to low-bulk, nutrient-dense supplements confected of mixed vegetable proteins designed for growth needs of weanling children. Ingredients may be grains or staple starches, oilseeds, legumes, protein isolates, fats, vitamins, minerals, and sometimes nonfat dry milk or other sources of animal protein. There are other types of formulated foods that children may eat; however, we are concerned only with those that are prepared explicitly to serve as a weaning food for low-income populations when the child's nutrient needs exceed those supplied by breast milk. Therefore, the commercially produced and distributed infant formula products fall outside the purview of this discussion.

Processing ranges from simple home-based procedures to village low-level technology, to industrial processing. Formulated foods fabricated outside the home can be delivered through public or private, nonprofit or commercial channels. Our definition focuses on the physical characteristics of the product and methods for its formula-

tion. Even though the delivery system is a separate design issue, it strongly influences the product's effectiveness.

In the 1950s, maldistribution of high-quality animal protein was identified as a major problem. Of the populations affected, the most vulnerable were weanling infants of low-income families in developing countries, who received insufficient quantities of both proteins and calories. Milk and other animal proteins were and remain largely unavailable to these infants. The question arose as to what appropriate alternative food sources might be used.

Attention turned to the possibility of mixing vegetable proteins, and the idea of a blended or formulated food was born. The basic rationale for formulated foods was their ability to meet the special nutritional requirements of weanling infants aged six to twenty-four months, which could generally not be satisfied by the traditional diets because of economic restrictions, food habits, or physiological constraints.

Breast milk is nature's well-designed infant food, adequate (assuming the mother is well nourished) until approximately six months of age, at which time the child requires more diverse food supplements for growth. Most traditional cultures have realized that weanling infants require soft foods and have solved this problem by adding extra water to starchy staples in order to produce a soft, semiliquid porridge. However, this solution to the texture problem has in itself been a cause of malnutrition because such watery mixtures are "too thin" to provide enough nourishment to the child. The child's stomach capacity is too small to consume enough of the bulky basic staples such as rice or rice porridge to meet the nutrient requirements; in other words, there is a bulk constraint. Thus, new weaning foods, mixed so as to increase the nutrient quality and density, are required in many countries where the quality of existing weaning foods needs improvement, where no concept of weaning foods exists, or where they are needed to replace expensive imported commodities.

An advantageous feature of formulated foods is that they may be specifically targeted to toddlers and are less likely to be shared among other family members, thus avoiding some of the leakage problems that occur when staples are distributed in supplementary feeding programs. These foods have been effective in treating malnutrition, and the technical and administrative feasibilities of producing them industrially, in village shops, or in the home have also been documented. Nonetheless, deficiencies in their distribution and particularly their price when they are sold, unsubsidized, through commercial channels have severely limited their consumption by the neediest groups. With proper design of the economic aspects of the intervention, its potential contribution appears significant.

The forms of nutrient-dense foods vary with the type of processing chosen. Foods produced at home or in the village are likely to be enriched variations of familiar porridges or snack foods. Industrially processed foods include a wide range of beverages, breads, biscuits, cookies, pastas, soup mixes, and special powders cooked as porridges or gruels. The typical weaning powder contains about 25 percent protein and 375 calories per 100 grams dry weight.

Although home mixes and village processing have been reported from many countries, data are not available to quantify global usage. Indications are, however, that production of formulated foods at this level is a growing and promising trend. Known global production of industrially processed formulated foods is summarized in Table 7.1. Although these foods have been manufactured in at least seventy-eight countries, the nutritional significance of this output for children in developing countries appears small. Current production capacity in developing countries is estimated to have a potential of reaching only 3.5 percent to 7 percent of those in need. (Inclusion of blended foods manufactured in the United States for food aid programs, such as Corn Soy Milk (CSM) and Wheat Soy Blend (WSB), triples this potential coverage figure.) However, the actual numbers of nutritionally needy children actually consuming these foods are even fewer because the high price and distribution systems often prevent access to the foods by those who need it most.

Principal design considerations for formulated foods include nutrient content, raw material supply, processing, consumer acceptability, distribution, and pricing. Nutrition education, which is indispensable for introducing new weaning foods, was discussed in the previous chapter.

II. KEY INTERVENTION DESIGN QUESTIONS

A. How Should the Nutrient Content of a New Weaning Food Be Determined?

The nutrient content should be shaped primarily by the diagnosed nutritional needs of the target population. Caloric density should be given primary attention. An appropriate balance between macronutrients and micronutrients should be achieved. Protein Advisory Group (PAG) Guideline Number 8 (1971) may be helpful in designing the nutrient profile of the formulated food. These guidelines, updated by the writers, state that:

The Net Protein Utilization (NPU) should be not less than 60 and preferably nearer 65.

The Protein Efficiency Ratio (PER) should be not less than 2.1 and preferably above 2.3 (the standard, casein, equals 2.5).

A level of protein contributing from 15 percent to 20 percent of total calories is recommended.

A level of fat contributing at least 25 percent of calories is desirable.

Caloric density per volume of the food in the weakest dilution in which it is consumed should be at least as high as breast milk (about 75 calories per 100 grams) and should be higher if feasible.

The products should contain minimum bulk and maximum protein availability and caloric density.

Linoleic acid content should be at least 1 percent.

If commercially processed, needed vitamins and minerals should be added to the foods.

Sugar is permissible since it enhances acceptability and increases caloric density, but it can also create dental caries and may promote poor dietary practices.

A detailed presentation of PAG guidelines can be found in Study II (*Nutrition Education*) of this series with an extensive discussion of relative nutrient requirement.

A basic element in the design of formulated foods is the concept that amino acid deficiencies in staple cereal grains can be improved by mixing them with other complementary protein sources, such as oilseeds and pulses. Such a combination can provide a protein roughly comparable in quality to milk protein. Beans and rice, corn and beans, and the Middle Eastern dish "hummos" with wheat bread are examples found in traditional diets.

Thus in the design of formulated foods, it is important to match amino acid patterns appropriately. It is also important that protein concentration not be so high as to stress the kidneys. Other considerations are digestibility of the protein, which is affected by fiber in the diet and the effects of processing, and potential toxic factors. Nutritional quality control should consist of examination of raw materials to determine the levels of pesticides, fungicides, and solvent residues; microbiological assays; and sanitation indices to assure that the processing environment is not a source of contamination.

The PAG guidelines are based on the physiological needs of preschoolers irrespective of the role the new food is to play in their total diets. The expected use of the foods, known nutrient deficits in the area calculated from consumption and nutritional status studies, and practical constraints will enter into nutrient content formulation

Table 7.1 Estimated Annual Production or Sales of Industrially Processed Formulated Foods, 1976

<i>Product</i>	<i>Country</i>	<i>Annual Total Production (millions of tons)</i>
Superchil and Fortesan	Chile	16,000 ^a
Colombiharina	Colombia	40
Duryea	Colombia	1,000
Bienestarina	Colombia	5,000 ^b
Incaparina	Guatemala	2,000
Faffa	Ethiopia	1,500
Super Maeu	Mozambique	2,400
Pronutro	South Africa	2,000 ^a
Superamine	Algeria	800
Supramine	Egypt	300 ^a
Special weaning food and Ready-to-Eat Snacks	India	700 ^c
Nutri Nugget, Protesnac, Protein Plus, Shaktihaar, and Paushtikahar	India	500 ^a
Bal-Ahar	India	40,000
Total		72,240 ^a

Source: Calculated from figures in Orr (1977), p. 2.

^a The Source for these data included estimates of both sales and production. The total production tally of 72,240 million tons includes annual sales figures for products with no total production figures (Colombiharina, Duryea, Incaparina, and Super Maeu). Thus, total productions for these four products may be underestimated in this table.

^b The figure for Bienestarina is the 1975 initial production figure, which may not be a good estimate of annual production.

^c Estimate.

in the individual case. If the food will be used as a partial supplement to an otherwise marginal or deficient diet, the quantity of all nutrients per unit volume may be increased in the attempt to compensate for overall deficiency. However, no nutrient should be included in a quantity high enough to prove toxic for individual children who happen to receive only the supplement.

B. What Raw Materials Are Recommended for Formulated Foods and How Can Adequate Supplies Be Insured?

Formulated food ingredients include cereal grains, such as wheat, corn, oats, rice, barley, and millet; oilseeds such as soy, cottonseed, sesame, groundnuts, and coconuts; legumes, such as chickpeas and

black beans; starches, such as plantains; fish protein; leaf protein; dry skim milk (DSM); sugar; oil; salt; vitamins and minerals; and various flavorings. Most formulated foods are based on the indigenous staple, with other acceptable ingredients added to achieve the desired nutrient density and quality.

Oilseed residues generally require special processing to ensure their adequacy as human foods. Protein concentrates of oilseeds, grain fractions, fish, and leaves can be used in industrially processed formulated foods, but they are less practical for village or home mixing. Synthetic amino acids have been used in some foods, but their costs (and those of single-cell proteins) tend to be too high to make them economical. Legumes, staple grains, and green leaves are the main sources of raw materials for village and home processing.

The food prepared at the home level must be based on cheap, available, practical, and culturally acceptable ingredients. In order to take the need for variety and seasonal constraints into consideration, in Upper Volta it was found to be best to teach a basic cereal porridge recipe to which a variety of enrichment ingredients could be added singly or in combination depending on the family's taste, convenience, and access to ingredients.

Choice of a cereal base usually is relatively straightforward. Enrichment ingredients, together with their advantages and disadvantages, are listed below:

a. *Oilseeds*

Soy: high biological value and high protein yield per acre; can be processed as flour, concentrate or textured; beany taste; heat processing required to inactivate trypsin inhibitor, hemagglutinins, and a goitrogenic factor.

Groundnuts: widely acceptable flavor and color; nutritive value slightly less than other oilseeds, and aflatoxins and skin may cause problems.

Cottonseed: 50 percent of cottonseed flour (dry weight) is protein; gossypol pigment must be removed or inactivated by heat; a gossypol nontoxic variety has been developed but is not widely used.

Sunflower: bland, digestible, nontoxic; darkens foods to which added sometimes making appearance unacceptable; high fiber content.

Sesame: nutritionally excellent and free of toxins (except for high selenium if grown in seleniferous soils); seeds need dehushing to remove oxalic acid; only 6 percent of oilseed yield, seed pods open and spill easily; often too expensive.

Coconut: can be cultivated on small scale; low protein yield per acre; dried copra is dirty and inedible and would require hygiene preparation methods for use as human grade food; high fiber content less suitable for infants.

b. *Protein concentrates*

Protein isolates of grain fractions, fish, oilseeds, and leaves are concentrated, nontoxic, and digestible protein sources.

Wheat protein concentrate: a 70:30 mixture of wheat to concentrate contains 25 percent to 50 percent more high-quality protein than wheat flour. The concentrate is made from the bran from flour milling.

Fish protein concentrate: protein content is 80 percent or more; almost tasteless, grayish powder; objectionable taste when poorly processed; two to three times the cost of oilseed flours.

Leaf protein concentrates: waste leaves of sugar beets, sugar cane, water hyacinth, and other plants can be used; current cost and acceptability problems similar to those of fish protein concentrate.

c. *Other fabricated protein sources*

Synthetic amino acids: have been used in cereal fortifications to enhance protein quality of other protein foods (see previous chapter); high cost.

Single-cell proteins: potential source of cheap protein; costs still high because technology not perfected (Milner, Scrimshaw, Wang, 1978 see Appendix A-4).

d. *Legumes*

Chickpeas: widely produced; highly acceptable flavor.

Mung beans: digestible; traditionally acceptable as weaning food.

Cow peas, black beans, kidney beans, lentils, and other varieties: popular in different localities; have not been used in industrially processed formulations but have been successful in home-based mixtures; may cause flatulence in some infants, so removal of the legume skin or other treatment may be advisable.

e. *Milk*

Dry skim milk: superior protein quality and palatability; relatively inexpensive and abundant at time of writing; continuing availability should be considered in countries not producing their own supplies.

Other forms of milk: even a small amount of milk greatly improves the quality of infant diets. The possibility of improving local milk supplies should not be discounted. Milk goats have

been successfully introduced to Indonesian villages. Milk buffalo interbred with carabao are equally hardy and can perform the same field labor.

f. Oil

Fats are the main concentrated calorie source in formulated foods; they may come either from oilseeds or from the addition of oil. Cost and potential rancidity must be considered, but oils often are an excellent way to increase caloric density.

g. Sugar

Increases acceptability and caloric density, but also may cause tooth decay.

The selection of nutrient source naturally will depend on the adequacy of the supply. The raw material procurement system should be designed to obtain the correct quality and quantity of materials at the right time for a reasonable price. Arranging contracts with farmers to buy a portion of their crop with certain quality specifications is one useful mechanism; the provision of foods by communities to village operations is another. Seasonality of supply requires attention to storage and to variation in ingredients.

C. What Are the Relative Advantages of In-Home Mixing, Village-Level Production, and Industrial Processing?

Home mixing involves the simplest technology and does not depend on an efficient market or other distribution system if local ingredients are used, nor on cash income where families grow the required foods. The home preparation involves creating "multimixes," e.g., staple and legume or staple and dark green leafy vegetable or other combinations (Jelliffe 1967). This has the additional advantage of building on existing traditions of mixing foods. Nonetheless, this approach must be done in conjunction with nutrition education, which must include an understanding of nutritional needs and of basic hygiene if the program is to be successful. Although such multimixes minimize the family's cash outlay, the educational aspects increase resource requirements. Such educational efforts in turn require a great deal of coordination and motivation by government or voluntary agencies.

Village-level processing may be organized either through commercial vendors or suppliers of other village-level processed foods or by village families or mothers working cooperatively. In the first case, the decision whether to work through existing processors should de-

pend on whether or not the target group normally purchases its products or could afford to do so. Getting the community to work together often requires a coordinator and group commitment to the project, although cultural specifics will dictate the appropriate form of community participation. The village-produced product may be more nutritious and palatable than the home-based because of more sophisticated processing.

Large-scale commercial processing generally requires a major investment for equipment, large quantities of raw materials, manpower, maintenance, and packaging for longer shelf-life. Industrial fabrication permits closer quality control, can create more varied forms, and can transform wasted by-products into usable foodstuffs, but production costs are higher and the products are frequently too expensive for the target population. These foods are often more appropriate for urban consumers who do not grow their own food and who use the existing commercial channels, and for institutional feeding programs (see Chapter 4, "Supplementary Feeding").

D. What Are the Procedures for Developing Products Acceptable to the Consumers?

One of the first steps necessary in making acceptable products is to determine food habits, preferences, and taboos. New weaning foods should be in an attractive form that is preferably similar to dietary items normally consumed, e.g., mashed beans or a protein calorie beverage where such purees or drinks are already familiar items. They must be nutritionally adequate and nontoxic and should have no off-flavors, smells, or colors.

To develop in-home recipes, technical assistants should work together with target group mothers using the process of formative evaluation described in Chapter 5, "Nutrition Education." Assistants should ask mothers to use their own ingredients and utensils to prepare the proposed recipes and must observe each stage of the preparation process, including the final step, when the food is fed to the infant. Each step must be modified through discussion with the mothers, so that all the ingredients, the procedures, and the food itself are practical and acceptable for daily use. For village-level processing, acceptable products should be developed by having villagers themselves take as much initiative as possible in the design of the new foods, using local ingredients. Industrially processed foods require the same systematic product testing and marketing trials normally used in developing commercial products, with the added element of educating consumers about the product's nutritional value. Many of the fail-

ures of formulated foods have been due to insufficient research on and testing of the consumers' taste and food preferences.

E. How Should Formulated Foods Be Distributed, Promoted, and Priced?

When the concept of nutrient-dense foods first emerged, retail distribution was considered essential because social welfare institutions did not have broad population coverage, were not prepared to store and distribute food, could not be counted on for continuous functioning, and might give the new product an image of inferiority. In remote rural areas, however, retail outlets are generally few in number and frequently charge relatively high prices, reflecting their low volume, high costs, and monopolistic positions. Poor families, even subsistence farmers, do patronize these stores or local market centers, but their purchasing power is very limited. In the past, attempts to make products commercially viable yet affordable by target groups have been unsuccessful. As a result, producers have terminated production, or else government subsidies, in the form of price subsidies in the market or distribution via social institutions, have been necessary.

It appears that the best long-range solution for isolated populations is to involve the community in making its own formulated foods. Foods that the mother can make in the home and that are readily available locally have no need of special distributive systems, so that the problems of food transportation, marketing, and bulk storage disappear, although the costs of the requisite nutrition education must be financed. Foods formulated at the village level likewise circumvent these difficulties. However, since larger quantities of food are handled, packaging and storage become more important considerations.

Promotion of an industrially produced food usually connotes large-scale marketing, with less direct contact with the target populations. It is frequently important to convince key people, such as health professionals, to recommend the weaning food to their patients. Marketing trials may be useful for indicating how much may be successfully sold and what factors to emphasize in promotions.

One of the major barriers to the effectiveness of industrially processed formulated foods has been high price relative to the target groups' purchasing power. Subsidies to processors or to consumers, state-owned production, and institutional distribution are ways of reconciling the conflict between nutritional objectives and profit objectives in the sale of these foods. Setting a high price with simultaneous use of food coupons for the target group may make a food more accept-

able than the same product with a "poor man's food" image at a lower price. While subsidies may not be needed for weaning foods produced at the home and village levels, the costs of nutrition education that teaches their use must be financed.

III. COSTS AND EFFECTIVENESS

Main contributors to the cost of industrially processed foods are raw materials, packaging, processing, and promotion. Costs for high-quality protein and calories can be reduced below the costs of the same nutrients from expensive animal foods such as fresh milk and meat, but they remain consistently higher than costs of protein and calories from vegetable staples. Table 7.2 shows projected percentages of total cost for five soya products manufactured in Uganda and Kenya, at three levels of production (Hitt and Austin 1976b). This table reveals typical economies of scale; as capacity utilization increases, fixed costs such as administration and most marketing expenses decline as a percentage of total cost. Table 7.3 shows costs of nutrients from three formulated foods compared with similar nutrient costs from milk, meat, and eggs (AID/Colombia 1976), and Table 7.4 shows a similar comparison with staples (Abbott 1969). These relative prices would, of course, change annually as commodity prices fluctuate.

Although prices of nutrients of industrially processed formulated foods are actually reasonable for the quality of the products produced, they have been consistently above the reach of the poorest target groups for whom they are intended. Reduction in price requires a large volume of production, which in turn must be supported by large-scale demand. Because it is difficult to generate demand for an unfamiliar food, a more effective strategy may be to start with home- and village-level production until the weaning food habit is accepted, making capital investment in a processed product less risky.

Effectiveness of the formulated foods in alleviating malnutrition has been demonstrated when they are consumed. In most cases, however, in which formulated food programs have gone through commercial channels and have not been subsidized, significant quantities of the food have not reached the neediest target children. Children are better reached through in-home production of formulated foods. Village-level and in-home preparation appear to be most cost-effective for rural areas. In the cities, there remains a need for processed products that are less expensive than commercial prestige products for certain segments of the target population. These products may particularly

Table 7.2 African Protein Products: Projected Percentages of Total Cost

<i>Capacity Utilization</i>	55%	75%	100%
<i>Production</i>			
Wages	10.0	8.3	6.7
Raw materials	36.5	41.5	44.6
Packing materials	14.6	16.6	17.8
Fuel and services	4.4	5.0	5.4
Maintenance	1.3	1.1	0.9
Vehicle	2.0	1.7	1.3
Total	≅69.0	≅74.0	≅77.0
<i>Marketing</i>			
Wages and commission	5.6	4.7	4.2
Sales and expenses	4.0	3.3	2.7
Promotion expenses	1.6	1.3	1.1
Advertising	1.6	1.3	1.1
Vehicle	1.3	1.1	0.9
Rent			1.1
Office expenses			0.8
Total	≅14.0	≅12.0	≅12.0
<i>Administration</i>			
Wages and benefits	6.4	5.3	4.3
Director's fees	1.3	1.1	0.9
Office expenses	1.6	1.3	1.1
Insurance and licenses	0.8	0.7	0.5
Bank audit, etc.	0.7	0.6	0.4
Total	≅11.0	≅9.0	≅7.0
<i>Depreciation</i>			
Buildings at 5%	1.6	1.3	1.1
Equipment at 10%	3.3	2.8	2.2
Vehicle at 20%	1.3	1.1	0.9
Total	≅6.0	≅5.0	≅4.0
Grand Total	100.0%	100.0%	100.0%

Source: Adapted from Hitt and Austin, 1976b.

benefit low-income working women who may earn enough to afford these less expensive products and may lack the time to prepare weaning mixtures from staple foods. Furthermore, the existing food distribution systems generally reach the urban dwellers more easily than they reach the rural poor. Given the rapid urbanization taking place

Table 7.3 Comparison of the Costs and Nutritive Value of Formulated Foods with Animal Protein Foods

	Colada ^a of Bienestarina (1 glass)	Colada of Incaparina (1 glass)	Colada of Duryea (1 glass)	Milk (1 glass)	Meat (1 ounce)	Egg (1 unit)	Fresh Cheese (whole milk) (1 ounce)
Estimated price to the user (US\$)	0.013	not available ^b	0.020	0.035	0.047	0.054	0.056
P.E.R.	2.50	2.29	2.15	2.7	2.5	3.5	2.5
Calories	168	138	140	141	36	80	79
Protein, grams	7.2	6.9	7.0	6.9	6.4	5.6	5.2
Cost per 100 calories	0.007	not available	0.014	0.025	0.131	0.068	0.071
Cost per gram protein	0.0018	not available	0.003	0.005	0.007	0.010	0.011

Source: Adapted from AID/Colombia (1976).

^aOne glass of colada is prepared by dissolving 25 grams of the powdered vegetable mixture in one glass of water, sweetening it with 12 grams of sugar, and boiling the mixture for 15 minutes. (Presumably the cost of sugar has not been included in the prices to the user.)

^bIn 1970 the price of 500 grams of Incaparina was \$0.095.

Table 7.4 Relative Costs of Formulated Foods and Staples

	<i>Price of Product (\$/lb)</i>	<i>Protein (%)</i>	<i>Price of Protein (\$/lb)</i>
<i>Staples</i>			
Chickpeas	0.05	20	0.06
Wheat flour	0.05	11	0.11
Beans	0.09	22	0.24
Skim milk powder	0.15	36	0.31
<i>Formulated Foods</i>			
MPF (India)	0.18	42	0.36
Arlac	0.21	42	0.40
Incaparina (Guatemala)	0.19	28	0.47
Pronutro	0.15	22	0.47

Source: Adapted from Abbott (1969).

in most developing countries, more people will become even more dependent on the commercial marketing system for their sustenance. This phenomenon alone makes it important for government planners to assess carefully the possible contribution that formulated foods can make to enhancing the nutritional value of the country's food supplies.

Consumer Food Price Subsidies

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I. DEFINITION AND RATIONALE

Purchasing power is probably a major determinant of nutritional status. A current objective of a majority of governments is to reduce or control real prices of some or all foods in order to improve consumption for low-income groups. Even countries that are unwilling to adopt policies that directly transfer income to groups falling below subsistence levels often are willing to transfer large sums to subsidize staple foods (Isenman 1978). Such subsidies are often granted for political and economic reasons rather than being directly motivated by nutritional concerns.

Pricing interventions have attracted a level of political commitment in many developing countries that exceeds commitment to all other nutrition intervention categories combined. The cost of food subsidies frequently has been up to five times higher than total national expenditure on health care. In 1975, for example, of the total government expenditure 21 percent in Egypt, 19 percent in Korea, and 18 percent in Sri Lanka went to food subsidies (Davis 1977). Given the magnitude of resources involved, the nutritional impact of consumer food subsidies deserves careful consideration.

Subsidies can take the form of price controls for specified foods, fixed margins (a limited percentage markup allowed at each process-

ing stage from producer to consumer), government subsidies on specified foods, or stamps or chits that give a discount to the holder on specified foods (with the government making up the discount). The first two forms—in which government controls over the market reduce the price from what it would be in an unrestricted market—are termed implicit subsidies, in that they require no direct government expenditure. The remaining forms—in which a government spends money to make up the difference between wholesale and retail prices—are explicit subsidies. The form of subsidy should be chosen after consideration of other key design issues, including whom to choose as the target group, what foods to subsidize, whether to ration these commodities, what price levels to set, and whether all the food should be subject to control or whether a parallel free market should be permitted.

Table 8.1 presents country-specific information from a number of price-altering programs. As can be seen, the majority subsidize cereals. In spite of missing data, it appears as if about half use both implicit and explicit subsidies and have special outlets, and that the majority have no rationing or explicit targeting but do coexist with free markets.

An additional reason for careful intervention design is that food price controls have a high potential for backfiring and achieving goals opposite to those intended. In particular, if distribution of subsidized food depresses its domestic price, farm production and farm income may be negatively affected and may lead to excessive reliance on foreign supplies. Second, if the subsidy program benefits the urban middle class and lower middle class rather than the poor, as is frequently the case, the direction of transfer may increase rather than decrease current inequity in income distribution and purchasing power.

Subsidy programs that are not designed explicitly to reach the entire population can be successful in increasing food consumption of low-income classes under rather special conditions. These conditions require that food eaten by the low-income groups—such as sorghum in rice-eating countries, for example—be selected for subsidy. As long as the subsidized food is in greater demand among the poor than among the more affluent, the benefits of the subsidy will be targeted toward the poor. They will consume larger quantities as intended, and the middle class will continue to purchase the higher-priced preferred food. Subsidies obviously cannot improve the food consumption of populations that do not have access to the program's distribution system; many rural groups fall into this category.

Among most deprived populations, purchasing power, dietary practices, and health status are limiting factors affecting nutritional status. The degree of the intervention's impact with respect to any one of these factors is largely conditional on the other two. Thus, subsidies may be a prerequisite for the success of other interventions. However, they may not measurably improve the nutritional status of vulnerable groups without simultaneous nutrition education and integrated health and nutrition surveillance. The type of situation most readily improved by subsidies alone obviously is that in which purchasing power is the most limiting of the three factors. This occurs in its most severe form when income is insufficient to purchase a total quantity of staple foods that cover the family's basic calorie and protein requirements.

II. KEY INTERVENTION DESIGN QUESTIONS

A. How Can Programs Be Targeted to the Nutritionally Needy?

Low income and participation in the cash market for food are primary criteria for targeting. The degree to which the program gives benefits only to low-income families will determine cost effectiveness. The government of Sri Lanka determined that 300 rupees (Rp) per month per family was needed for a minimum diet and restricted participation to those with incomes below this figure. This restriction, which eliminated unsustainable program costs by reducing the number of eligible families from 13 million to 7 million, was feasible because of the economic necessity of improving economic growth and the political commitment to improving the well-being of the needier groups. Executing cutbacks after a program is underway poses problems that may be avoided by initially limiting eligibility to the most needy groups.

Targeting on the basis of income requires a bureaucratic network with a high capacity for collecting and processing information, and thus it may not be practical where such institutional capacity is lacking. Geographical targeting may be used to restrict shipment and distribution of subsidies to deficit regions or neighborhoods. In Mexico, distribution of liquid milk in low-income neighborhoods of Mexico City appeared to be effective in restricting benefits to residents, in part because milk is difficult to store and resell and in part because of the program's coupon system (Sanchez, Overholt, Kennedy, and Aus-

Table 8.1 Price-Altering Programs

Country	Commodity	Implicit Subsidy	Explicit Subsidy	Rationing	Explicit Targeting	Free Market	Special Outlets
Asia							
Bangladesh (Davis 1977)	rice wheat sugar vegetable oil salt	—	yes	yes	low-income population; government servants; military; institutions	yes	yes
Burma (Davis 1977)	rice	—	yes	yes	low-income government employees	yes	yes
India (Davis 1977; Swaminathan and Devadas 1975)	wheat rice coarse grains	export ban; restriction of interzonal trade, some government monopoly	yes	in some states	in some states, low- income population	retail only	yes
Indonesia (Davis 1977; Soemardjan 1975)	rice wheat sugar	yes	yes	no	no	no	no
Korea (Davis 1977)	mixed rice and barley	yes	—	no	no	yes	—
Nepal (Davis 1977)	rice	—	—	no	—	—	—
Pakistan (Davis 1977; Rogers and Levinson 1976; Rogers 1978)	wheat sugar	yes export ban; government monopoly	yes no	yes yes	no no	yes no	yes, most urban yes
	edible oil rice	yes; government monopoly on wholesale purchase and export	no	no no	no no	no yes	no no
Philippines, (Andrews 1978)	grain	fixed prices	no	no	no	no	no
Sri Lanka (Isenman 1978, Gwatkin 1978)	rice wheat sugar	yes	yes	yes	yes (since 1977)	yes	yes
Thailand (Davis 1977)	rice other foods	export ban —	no food stamps	no yes	no low-income population	yes	no

Table 8.1 (Continued)

Country	Commodity	Implicit Subsidy	Explicit Subsidy	Rationing	Explicit Targeting	Free Market	Special Outlets
<i>Africa</i>							
Chad (Center for Research on Economic Development 1977)	millet (until 1970) rice sugar oil consumer goods	—	yes, on imports	—	—	—	yes, few, mostly urban
Egypt (Taylor 1976)	wheat sugar beans rice tea	fixed margins yes	yes yes	no yes	no —	no yes	no yes
Zambia (Center for Research on Economic Development 1977)	rice consumer goods	fixed price margins; government monopoly on imports fixed prices, margins	on imports —	— —	— —	— —	— —
Kenya (General Accounting Office 1975; Brown 1977)	maize wheat beef (until 1975)	fixed prices, margins; international trade restrictions	yes	—	—	—	yes
Mali (Center for Research on Economic Development 1977; Intech Inc. 1977; Pinckney 1975)	millet sorghum rice groundnut oil	government monopoly (ineffective)	yes; government stores operate at loss	yes	no	yes; black	yes; urban
Mauritania (Center for Research on Economic Development 1977)	rice sorghum millet	— yes	yes yes	— yes	— free to distribute; subsidized to low-wage earners	— —	— yes
Morocco (Davis 1977)	sugar edible oil flour products	—	—	no	no	—	no

Table 8.1 (Continued)

Country	Commodity	Implicit Subsidy	Explicit Subsidy	Rationing	Explicit Targeting	Free Market	Special Outlets
Niger (Center for Research on Economic Development 1977)	grain	government monopoly (ineffective)	yes; government stores operate at loss	no	no; inferior quality	yes; black	yes
Nigeria (Simmons 1978)	milk sugar flour	price controls on imports	on imports	—	—	—	—
Senegal (Center for Research on Economic Development 1977)	grain	government monopoly (not enforced)	yes; government stores operate at loss	no	—	yes; black	yes; mostly urban
Somalia (Partrey 1978)	all foods	fixed prices (managed economy)	—	—	—	—	—
Tunisia (Austin 1977)	cereal milk meat some other foods	fixed prices, margins	yes (f)	—	—	—	—
Upper Volta (Center for Research on Economic Development 1977)	grain	government monopoly (ineffective fixed prices and margins)	yes	—	—	—	yes; urban
Zambia (Davis 1977)	wheat	government monopoly	yes; on imports	no	no	—	—
	maize	government	—	no	no	—	—
	edible oil	monopoly					
	some other local crops						
Latin America							
Bolivia (Sampere 1978)	beef	price ceiling	—	—	—	—	—
Brazil (Moran 1975)	grain	government competes with free market	—	—	—	yes	yes
Caribbean area (McIntosh 1975)	—	price controls, fixed margins	—	no	no	yes	no

Table 3.1 (Continued)

Country	Commodity	Implicit Subsidy	Explicit Subsidy	Rationing	Explicit Targeting	Free Market	Special Outlets
Colombia (Moran 1975; McIntosh 1975)	grain	fixed prices; government controls on imports	yes	—	—	yes	yes
Costa Rica (Moran 1975)	—	fixed prices; government competition with free market	—	—	—	yes	yes
El Salvador (Moran 1975)	grain (?)	fixed prices	—	—	—	yes	no
Guatemala (Moran 1975)	grain (?)	fixed prices	—	—	—	yes	no
Guyana (Moran 1975; Sampere 1978)	grain (?)	fixed prices	no	—	—	—	yes
Honduras (Moran 1975)	grain	fixed prices	—	—	—	—	yes
Jamaica (Moran 1975)	grain	—	—	—	—	—	yes
Mexico (Austin and Cassus 1975)	maize, wheat, beans, sorghum, edible oils, other food, nonfood items		yes; stores operate at loss	no	no	yes	yes
Peru (Moran 1975; Farren 1975; Sovnick 1975)	wheat, maize, soy oil, rice, lard, beef, potatoes, onions, other foods	ceiling prices	yes; on imports	no	no	yes; price controls not enforced	Lima only
<i>Europe and North America</i>							
United Kingdom (Davis 1977)	milk, butter, cheese, flour, bread, tea	—	yes	no	no	yes	no
United States (Sexauer 1977)	all American-produced and some imported foods	no	food stamps yes; sliding scale income supplement		yes; low-income population	yes	no

*No free market in five major cities.

tin 1978). In the case of food grains, however, regional reduction in prices may create an incentive for smuggling (Singh 1973).

Although targeting on the basis of nutritional status or "at-risk" factors within the family has not been attempted, it could be more sensitive than regional targeting and simpler and more reliable than income determination.

Administrators should make targeting decisions after balancing the cost of food going to nontarget groups against the costs required to administer eligibility restrictions. If rationing is chosen, the ration size should be determined in proportion to calculated nutritional needs and should meet these needs with a margin of safety if supplies permit; leakages must be expected and compensated for, as was noted in Chapter 4. The program administrators also must decide whether ration cards are legally transferable. If they are, the program's nutritional goals may be undermined, but incentives for black marketing will be reduced.

B. What Commodity Should Be Subsidized?

Ideally, the program will subsidize a commodity consumed by the target group but not by non-needy groups. In this regard, it might be preferable to subsidize cassava, sorghum, or corn rather than more costly wheat or rice. Identifying consumer food patterns is an essential prerequisite. The product's acceptability to the target group is paramount, but tastes are not immutable. Lower prices can cause shifts to other foods.

Sometimes scarce products consumed by middle- and upper-income consumers, such as sugar or oil, are subsidized. These subsidies to more affluent groups, however, should generally be viewed as political programs rather than as nutrition programs. Thus, the product selected should have a high demand among the target group and a decreasing demand as income rises, unless program access is administratively restricted to lower income groups.

The commodity selected should also be available in adequate quantities. The subsidy may increase demand, and supply shortages could cripple the program.

C. Should Rationing Be Used?

If supply shortages exist or if higher income groups desire the product, rationing is needed. Rationing requires capable administrative apparatus and procedures, but these need not be complicated. The ration

size should be sufficient to meet the estimated deficit and to cover leakages. (See previous discussion of supplement quantity in Chapter 4). Ration privileges should generally not be transferable.

D. What Pricing Policy Should Be Pursued?

Ideally, in order to reduce substitution, a price subsidy should allow the poorest consumers to obtain an adequate diet while spending the same amount they spend without the subsidy. In theory, this is what is achieved by the U.S. Food Stamp Program's sliding scale. This system is complex to administer, however, and it is therefore probably less satisfactory for most developing countries than fixed prices suitable for lowest-income families. Food stamp systems may give more coupons to the very poor and to families with more children.

Price controls may cause active black markets to spring up in countries in which the government does not play a major role in determining price structure. To avoid political resistance to change, prices should be fixed for predetermined intervals and be subject to periodic review. It probably is better to err on the side of lower prices and higher costs than to risk inadequate support to the poorest in the population.

Fixing percentage margins at each stage of the marketing process avoids the rigidity of fixed prices. However, this kind of pricing policy reduces incentive to try to bargain or shop for best wholesale prices and invites collusion between buyer and seller. The latter is particularly likely if margins do not allow for price increases sufficient to cover real costs of bringing foods to remote markets. Margins are difficult to enforce and ultimately provide unsatisfactory protection to the poor if the original supply price is high.

E. What Distribution Systems Should Be Used?

Subsidy programs have the choice of using existing marketing outlets or of setting up special outlets, which may be run either privately or by the government. Use of existing food retail outlets maximizes coverage and saves government capital expenditure. Some margin must be allowed to retailers to motivate participation in the program. Specially established outlets are suited to areas where retail establishments are insufficient. Unless the government already operates a retail system, it is less expensive to arrange for such special outlets to be operated privately with a small profit margin under government supervision.

F. Should All Sales of the Food Be Controlled or Should a Parallel Free Market Exist?

If it is possible to divide the market and subsidize one distinguished grade or type of the food, a legal "parallel" (although different in terms of quality) market performs several useful functions (Food and Agriculture Organization 1979). If a better grade is available on the open market, there is less incentive to pay black market prices for the subsidized grade. Moreover, producers and middlemen can make up the loss from selling lower-quality food to government at fixed prices through the price charged for the remaining higher-quality food (Narain, n.d.) as has been done in Peru (Shepherd, Prochazka, and Furnish 1967). If two qualities cannot be distinguished, a parallel market can serve the same functions, but careful control is required to prevent diversion of the subsidized supply to nontarget consumers. A parallel free market also lessens disincentives to domestic farm production.

G. What Should Be the Form of the Price Intervention?

In addition to price controls and subsidies, specific forms of price intervention include market injections (subsidized imports distributed through the existing market system); other market interventions, including export laws, rationing, and interzonal restrictions; and food stamps or coupons. While many considerations determining the choice of forms are political or are based on macroeconomic policy, the form chosen probably affects nutritional impact.

The advantages of food stamps are that they can be used at existing retail outlets; that they distort the market less than other forms of intervention, since stamps are spent like money; and that they can be issued on a sliding scale to meet individual needs. Disadvantages are that printing and distribution costs are substantial; eligibility determination is complex to administer; and nutritional impact is not assured unless stamps are tied to specified foods.

Price controls without subsidies form the basis for a variety of programs, depending on the extent to which the government controls the price structure. When controls cannot be strictly enforced, active black marketing raises prices higher than the free market, and shortages tend to occur. The effects of lowered price on food consumption of different groups should be the same regardless of the intervention mechanism, subject to the previously discussed considerations. All these interventions will have effects that must be considered on

production incentives and on the national economy. Their survival also will depend on foreign exchange needs, political demands, budgetary limitations, and resource availability.

III. COSTS AND EFFECTIVENESS

Subsidy programs have been criticized for high costs. Reutlinger and Selowsky (1976) have estimated that with a general food price subsidy, it would cost \$12 to get \$1 worth of food to the target group. A perfectly targeted food stamp program would cost about \$1.33 to provide \$1 worth of food. Actual costs per child under three years old or per pregnant or lactating woman are inevitably higher than those for the needy population as a whole.

The few attempts to quantify the impact of price subsidies on food intake indicate that it can be substantial. Pakistan's ration system was estimated to provide increments equal to 6 percent of caloric intake and 8 percent of protein intake in the urban population with below-median income (see *Consumer Food Price Subsidies*, Study V). The U.S. Food Stamp Program is estimated to increase food consumption by 35 to 60 cents for each dollar of stamps. Ration programs in Sri Lanka in 1970 provided about 20 percent of total caloric intake and 14 percent of income for the lowest income group (Isenman 1978). The ration system in Kerala state in India was estimated to have increased calorie consumption 20 percent to 30 percent among low-income groups; it was also positively associated with the nutritional status of pre-schoolers (Kumar 1979). The ultimate effect on intake will depend on the target group's income elasticity of demand for the particular subsidized product and the relative prices and cross-elasticities for other goods. Taylor (1976) has calculated that termination of food subsidies in Egypt would have a powerful negative effect on the economy as a whole.

In the CONASUPO program in Mexico (Study V), the percentage contribution of milk to both calorie and protein adequacy among milk-group preschoolers is larger than the percentage among families and larger than that among members of the control group. This may indicate that the milk-group family favors the child in the distribution of CONASUPO milk. However, no discernible anthropometric impact relative to a matched control group was found. It is perhaps relevant that the controls were nonprogram participants living in the same neighborhoods; it is possible that these families may have been more affluent and less nutritionally deprived, which cloaked a program effect.

While further empirical research is needed to document the cost effectiveness of the varying design options available for pricing interventions, existing evidence suggests that where income limits food intake in a nutritionally marginal population, a target-oriented price system can reduce nutritional deficits.

Agricultural Production, Technical Change, and Nutritional Goals

Richard H. Goldman and Catherine A. Overholt

I. DEFINITION AND RATIONALE

Very little attention has been given to implications for policies influencing agricultural resource allocation when nutritional goals become important in national development strategy. Consequently, the focus of the subsequent discussion is on a framework for incorporating nutritional considerations into the formulation of agricultural policies and programs. The particular concern here is the impact on the malnourished of policies aimed at increasing agricultural output or changing farm technology.

In recent years, the increase in agricultural production in many developing countries has principally resulted from changes in output per hectare rather than from increases in cultivated area. This is a reflection of the importance of irrigation, the technical change embodied in new seed varieties, and the increased use of fertilizer. These factors have also led to major changes in crop patterns in some areas of the world. In addition to output-increasing technologies, labor-saving mechanical technologies such as tractors and threshers have become popular in some developing countries. Public policy can have an important influence on the crops that become the focus of output-increasing research activities, the crop combinations chosen by farmers, and the pattern of technical change. How can nutrition planners take advantage of this policy potential?

Increasing agricultural output differs from other nutrition intervention strategies in three basic ways: (1) the majority of malnourished people may not be members of farm families and so may be indirectly rather than directly affected by new agricultural technology; (2) agricultural technology may be a principal resource of this intervention, but its impact on the target group depends on the macroeconomic environment, particularly agricultural price formation; and (3) increasing agricultural output can serve many policy goals, some of which conflict with the objectives of nutrition policy. This chapter will not discuss specific issues relating to the design and dissemination of agricultural technology, as an extensive literature on this subject already exists. Rather, the focus is on a conceptual framework for integrating nutritional goals into agricultural production policies.

II. KEY INTERVENTION DESIGN QUESTIONS

A. What Are the Mechanisms Through Which Agricultural Technology Generates Changes in Price and Income and Nutritional Effects?

As agricultural output grows, the food consumption of malnourished people may increase as a result of lower food prices or higher incomes. These price and income linkages are depicted in Figure 9.1. Clearly, economic function is an important factor that determines the likelihood that agricultural policy will generate price or income effects. Frequently, nutritional target groups comprise a people with widely different economic functions. That is, some are more directly related to agricultural production than are others. In the context of nutritional goals, therefore, the choice of agricultural policy instruments must reflect awareness of the roles of underfed people in the economic system and a sensitivity to the economic linkages between crop production and those people.

Within any farm population, those who first adopt new technology are frequently the least in need of nutritional intervention. Many authors (Hayami and Ruttan 1971; Johnston and Kilby 1975) have called attention to the fact that affluent farmers have the resources prerequisite to innovation, are best informed about new possibilities, and thus have the least to fear if new methods fail. Recent evidence suggests that smaller farmers frequently adopt new technologies after a two- to five-year lag. However, the group most frequently in need of more food in farming areas includes those with insufficient land to be

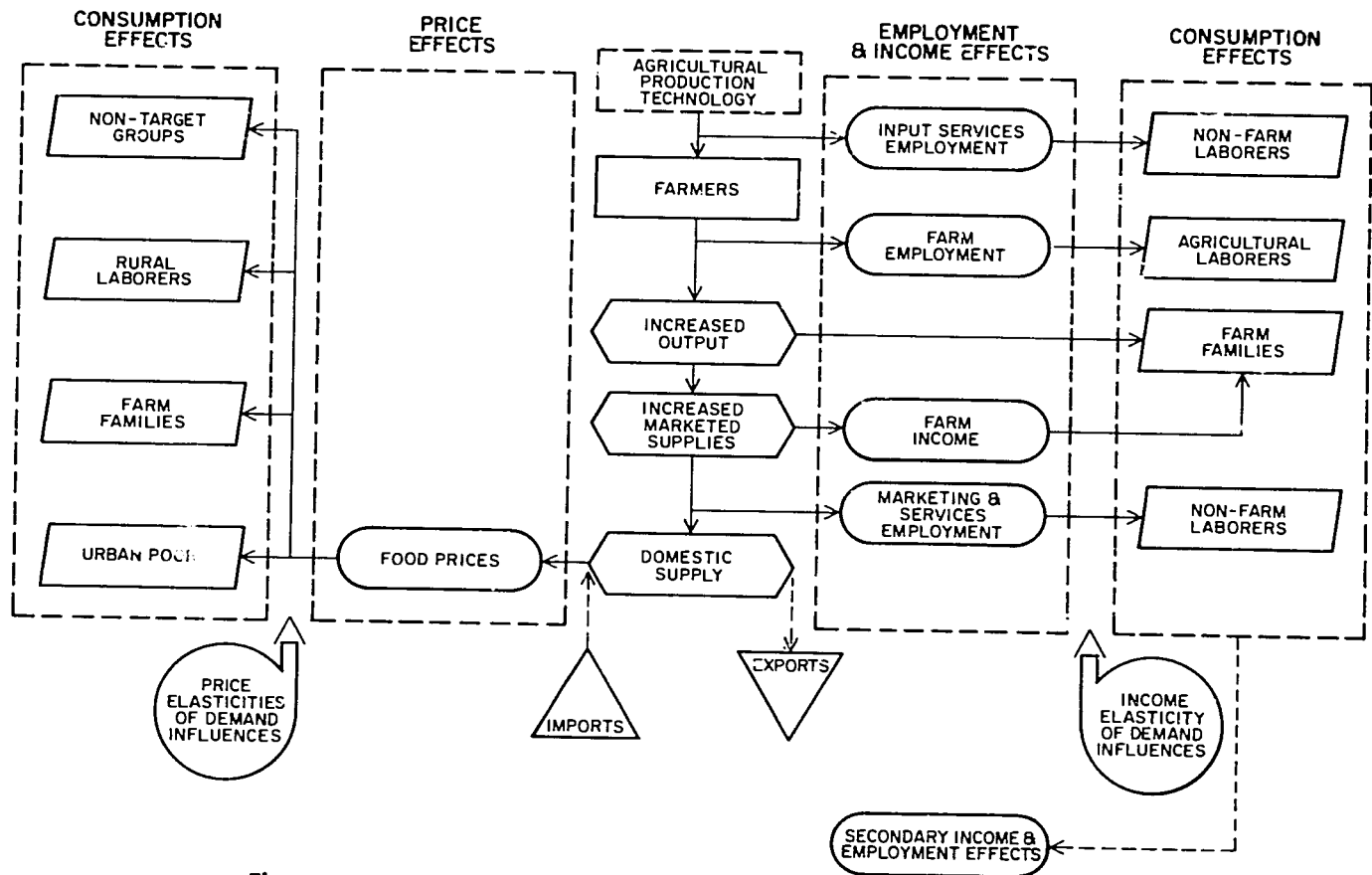


Figure 9.1 Employment, income, price, and consumption effects of agricultural production technology.

self-sustaining and the landless laborers. In India in 1961, for example, 25 percent of the agricultural work force operated no land and another 38 percent operated fewer than five acres (Mellor 1976). For these reasons, the benefits of new agricultural technology cannot be channeled to the nutrition target group in the direct manner that supplementary foods, nutrition education, and health services can be targeted.

Agricultural innovations with the goal of better nutrition should be directed at least toward lower-middle-income groups rather than the elite. However, the poorest third to half of the population will be affected only secondarily by the design characteristics of the innovations, as these affect the labor and consumer markets.

The technology will have direct income and consumption effects to the extent that the nutrition target group is composed of farm operators and agricultural laborers on farms where new technology is introduced. Agricultural workers may receive wage increases or fuller employment as a result of an expansion in output that generates additional labor demand (although the reverse might occur). The segment of the target group that is not involved in farming, however, will depend on price effects for improvement in food consumption, at least in the short run.

The groups most dependent on price effects are the urban poor and the low-income rural nonagricultural workers. However, both these groups may benefit directly from secondary employment effects in processing and service activities generated by increased agricultural output. A breakdown of census data on the rural labor force in fifteen developing countries into agricultural and nonagricultural sector workers is presented in Table 9.1. It shows that 12 percent to 49 percent are classified as nonagricultural. Although few countries have accurate employment profiles for these nonagricultural rural dwellers, it is clear that most low-income rural families (including many farm families) as well as urban families rely on the market for at least a portion of their food supplies.

The following tabulation indicates which effects of increased production have the greatest impact on target-group members engaged in agricultural and nonagricultural labor.

	Agricultural	Nonagricultural Labor	
	Labor	Rural	Urban
Price effects: direct	X	X	X
indirect	X	X	X
Employment effects: direct	X		
indirect		X	X

Table 9.1 Distribution of Employed Labor Force Between Agricultural and Nonagricultural Activities in Rural Areas, Selected Developing Countries

Category	Country	Year	Primary Employment	
			Agricultural (%)	Nonagricultural (%)
Rural areas, excluding urbanized settlements	Kenya	1969	72	28
	Iran	1972	67	33
	Guatemala	1964	86	14
	El Salvador	1975	68	32
	Colombia	1970	77	23
	Venezuela	1971	53	27
	Chile	1970	70	30
	Brazil	1970	88	12
	Indonesia	1971	72	28
	Thailand	1972	82	18
	Philippines	1970	72	28
	West Malaysia	1970	68	32
	Korea, Republic of	1970	81	19
	Taiwan	1966	51	49
	India	1966/67	80	20
Rural areas, including rural towns	Colombia	1974	57	43
	Philippines	1970	60	40
	West Malaysia	1970	63	37
	Korea, Republic of	1970	75	25
	Taiwan	1966	49	51
	India	1966/67	76	24

Source: Anderson and Leiserson 1978.

Direct effects involve changes in labor use and wages and the price of the crop for which production is increased. Indirect effects involve secondary changes in employment demand and in the prices of other commodities that result from increased production.

Identification of the target group within the economic system is an important planning task. When the accuracy of income data is suspect or when such data are incomplete, the breakdown of data from national nutrition surveys by occupation and region should be used to locate the target group according to the criterion of nutritional need. The relative costs of alternate technologies also enter into the decision whether to attempt to achieve income effects or price effects, since the crops and technologies best serving the one purpose do not necessarily achieve the other.

B. How Can Increased Agricultural Output Lower Food Prices?

In regions that lack adequate transportation and other marketing infrastructures, an increase in food production may result directly in a decrease in food prices. However, an increase in production of a domestic good in a country will not lead to lower domestic food prices if the new production is a substitute for imports or is exported freely.

For this reason, any reduction in price inevitably requires the government to make a policy decision either to restrict exports or to allow the increase in domestic production to supplement rather than substitute for imports. These possibilities must be considered before one makes assumptions about or relies on econometric estimates of the price elasticity of the "domestic" demand curve. Even if domestic production substitutes for imports, however, government can reduce the amount of public revenue required to set and maintain prices at equitable levels as long as domestic supply increases more rapidly than demand. Under constant price conditions, the amount of time required to achieve food grain self-sufficiency depends on (1) the initial degree of dependence on imports; (2) the rates of growth of food grain production, population, and average per capita income; and (3) the change in the distribution of income. Calculations in Study VI show that even under conditions of high sustained agricultural growth, many poor countries will require at least 20 to 45 years to reach food self-sufficiency. Until that time, imports and direct consumer price subsidies will be required if increases in domestic production are to result in supply expansion and lower food prices. It is important for those concerned with food policy to undertake a realistic assessment of prospects for national trade and price policy. These policies ultimately determine the likelihood of price or income changes emanating from agricultural growth and the impact of agricultural expansion on the malnourished population.

C. When Food Supply Expansion Lowers Food Prices, What Is the Impact on Poor Consumers?

Economic conditions under which an increase in crop production actually results in lower food prices offer potential for an important impact on the level of food consumption for those in the nutritional target group. The extent of the impact depends on the particular crop whose output is expanding and its role in the food consumption behavior of both the malnourished and the well fed. Both must compete in the same market for access to the expanded supply. An understanding of

these relationships may help in formulating agricultural policy, particularly in the selection of crops on which to focus output-increasing policy instruments.

To select the combination of crop activities and subsidies that will have the greatest impact on the net nutritional intake of the target group through price effects, it is necessary to consider three main factors: competition between target-group members and higher-income groups in the marketplace; substitution of nutrient sources within the target group; and the cost of producing nutritional impact. Direct price elasticities by income level can be used to calculate the initial pressure exerted on the market by each of the groups that compete for the supply increment following a decrease in price. The competitive strength of target groups relative to nontarget groups is improved to the extent that they have a relatively high price elasticity of demand and a relatively large initial level of per-capita consumption of the staples for which production has increased. When the initial demand pressure exerted by all groups in response to a price decrease exceeds the supply increment, prices begin to rise again; in response, target-group members shift their expenditures to other foods that become relatively less expensive. The target group's ability to compete in the market will depend in part on the specific commodity. Their commodity-specific increase in nutrient consumption from the supply increase will be greater than their total net increase because of substitution.

Pinstrup-Andersen and coworkers (1976) have developed a useful procedure for estimating the impact on the target group that results from supply expansion of specified foods. A complete matrix of direct and cross-price elasticities for a full set of foods across target and nontarget groups can be estimated through the use of assumptions that render it soluble for equilibrium prices and group-specific quantities. In this manner, the distribution of the full supply increment as well as the impact of substitution effects following price changes can be traced to each group. The analysis suggests that leakage of benefits to nontarget-group members can be quite large, depending on the crop chosen for expansion. These results may be of particular interest in the context of a policy that attempts to support producer prices while subsidizing lower prices for consumers. In this case, it is important to identify food crops that "target" well on poor consumers and thus reduce the leakage of budgetary resources to the adequately nourished population. Exclusive emphasis on this approach, however, may result in biased or deflated cost efficiency estimates unless conscientious effort is made to quantify other relevant benefit streams, such as income linkages to target-group members.

A complete measure of the net impact of an increase in a particular crop's output on food consumption should take into account the impact on total crop production and the implications for relative price changes. For example, evidence with respect to the net impact of the "Green Revolution" on food prices appears to be positive in spite of substantial crop substitution effects. In the case of India, Ryan and Asokan (1977) have shown that wheat production expanded by 136 percent in the first ten years of the high-yielding wheat program at the expense of a total net reduction of only 22 percent in acreage used for the production of pulses. The net effects on prices were to lower those of both wheat and pulses. However, a full assessment of the impact would have to examine changes in the diets of weanling children who need protein from pulses, oilseeds, or more expensive animal sources in order to overcome the bulk constraint posed by a cereal diet.

D. How Can the Introduction of New Technology Improve Employment and Income of the Target Group?

New agricultural technology can have a direct impact on nutritional well-being when a significant portion of malnourished people are in the families of those who operate small farms. Evidence from the Green Revolution era suggests that compatibility of new seed varieties and cultivation techniques with the agroclimatic environment is the principal factor that determines the adoption of new technology. Within an agroclimatic zone, factors such as farm size and tenancy frequently have little to do with relative farm productivity, the use of new seed varieties, and even the per-hectare level of use of fertilizer. This suggests that biases that may exist in agricultural input markets may be less important than the nature of available technology in determining which farmers benefit from technology. The implication is that allocation of resources to agricultural research should reflect particular concern for "more difficult" agroclimatic environments if impact on malnourished farm families is a principal objective.

Whether agricultural policy should emphasize food crops or cash crops for adoption on small farms is also an important issue. In general, the crop that deserves emphasis is the one most likely to generate the highest income per unit of cost. However, in areas where undeveloped and imperfect markets result in a large spread between farm prices and retail prices for food crops, a bias toward food crop production is likely to result in greater home consumption. Other issues that relate to the relative importance of food and cash crops and to the input of biochemical technology are discussed in Study VI.

In most cases, a large proportion of malnourished people will be associated with agriculture not as farm operators but as wage laborers. Even under conditions of high growth, the majority of the population in developing countries will be employed in the agricultural sector and related industries for years to come. For this reason, ad hoc approaches to agricultural resource allocation that emphasize immediate gains are questionable. More effective policies exploit agriculture's potential for producing a complex of employment and income-generating linkages to target-group members. Mechanized inputs are often economically inefficient in labor-abundant regions, although their use is often encouraged by inappropriate price policies and subsidies. If agricultural expansion follows a labor-intensive path, employment will be increased both directly and indirectly. A large portion of wages earned from agricultural work is spent on consumer goods and services that are, themselves, efficiently produced by means of labor-intensive technologies. These indirect employment effects can be very large.

In a simulation of employment impact from agricultural growth in North India, Raj Krishna (1974) estimated that between 1968 and 1979 a 5-percent increase in farm production generated by the most likely technologies in that region would actually decrease farm employment. This was largely the result of the introduction of mechanical threshers. Even in this case, however, the total net effect on employment was positive. The income from the production increase generated a major increase in demand for many farm inputs and final consumption goods produced by means of labor-intensive techniques. However, the nutritional consequences will depend on which individuals lose and gain jobs. Investment in crop research, extension, and marketing organization should anticipate such indirect demands generated by initial agricultural growth, and should diversify to secondary crops for which there is a high income elasticity of demand. In addition, nutrition planners should be aware of price policies that provide inappropriate incentives to mechanical technologies in agriculture.

E. What Potential Differences Exist Between Strategies Emphasizing Price Effects Versus Those Generating Income/Employment?

A food policy that aims to reach target groups through price effects will encourage agricultural policies that will result in the expansion of crops whose domestic price will be sensitive to output change and whose production increment will be consumed disproportionately by

the target group. The analytical emphasis in this policy environment will be on domestic policies influencing agricultural price formation and on the price-elasticity-of-demand characteristics associated with various crops. Industrial crops or crops that are exported or used as import substitutes, such as cotton or sugar cane, will be ignored.

On the other hand, a strategy that relies on employment and income effects will encourage agricultural policies that foster labor-using production technologies on small and large farms and that pay close attention to policies exploiting the employment potential generated by the secondary demand effects of the initial expansion of agricultural output. This strategy is based on the notion that income streams generated by labor-intensive agricultural growth are captured by lower-income members of the labor force who have a high propensity to spend additional income on commodities produced by labor-using techniques (see Mellor 1976).

An effective strategy will usually include policies aimed at both price and income effects. However, policy analysts should recognize the different implications of the two components for agricultural resource allocation.

III. COSTS AND EFFECTIVENESS

The task of calculating costs for agricultural interventions poses some distinctive problems. As for any intervention, market values of all program inputs are first identified. Goods or services whose market costs differ from social costs are then shadow-priced. Shadow prices can frequently be obtained from national planning agencies or development banks; Gittinger (1972) provides a detailed discussion of appropriate methodology. Nutritional benefits can be measured by consumption and nutritional status surveys, as illustrated in the case study to Study VI. It is difficult to quantify and to attribute to the intervention the effects of such benefits, for several reasons: (1) the projections are complex, as noted previously; (2) increases in income and in staple food grains consumption do not automatically benefit the vulnerable preschool and pregnant and lactating groups; and (3) technical innovation per se may not have a measurable effect on the most deprived target groups. Agricultural investments may produce other benefits in addition to nutritional improvement, e.g., foreign exchange generation, regional development, and public revenues. These should be weighed against the total program costs.

Reutlinger and Selowsky (1976) suggest that direct and targeted subsidies are a more effective way to achieve nutritional goals (see

Chapter 8). In many countries, the fiscal role of agriculture as a source of public revenue to finance these subsidies may be more important than other effects. This further complicates the cost-effectiveness evaluation. Additional employment and income provided by agriculture may also reduce the size of the target group that requires subsidies. A major conflict arises here, in that the capital investment required for agricultural growth and that required for food subsidies are large and may compete. The average percentage of public capital expenditure spent on subsidies in Bangladesh, Burma, Egypt, Indonesia, Korea, Morocco, Pakistan, and Sri Lanka was reported by Davis (1977) to be 43 percent. For developing countries as a group to achieve a food grain compound growth rate of 2.6 percent over the 1974–1985 period, an estimated \$25 billion would be required in the first five years (Burki and Goering 1977). If demand trends continue, the developing countries would still be short of food grains in 1985 by about 33 million tons. Current effective subsidy programs may become untenable unless fiscal requirements of agricultural growth and consumer subsidies are properly phased over time in an overall nutrition strategy. Increased attention must be given to the search for cost-effective subsidy instruments (see Reutlinger and Selowsky 1976) and to policies for taxing agricultural productivity.

Reutlinger and Selowsky's (1976) projections of the size of undernourished populations between 1975 and 1990 show that agricultural and economic growth alone cannot eliminate malnutrition. However, they do show a decrease from 48 percent to 19 percent of the population who suffer deficits in excess of 250 calories below requirements. Agricultural growth alone cannot eliminate poverty. However, a strong commitment to agricultural growth combined with an appropriately targeted allocation of resources within agriculture is essential to alleviating the worst nutritional problems.

Integrated Nutrition and Primary Health Care Programs

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I. DEFINITION AND RATIONALE

We define an integrated nutrition program as one that combines some *direct* nutrition interventions (supplementary feeding, nutrition education, formulated foods, fortification, consumer price subsidies, or agricultural production) with some *indirect* nutrition interventions (health care, sanitation, family planning). Integration can occur in various forms and degrees, but it must be an intentional fusion or coordination of goods and/or services to a common target group. Our definition of integration as a cluster of health-related activities places it within the context of broader community development efforts.

A. Biosocial Rationale for Integration

The services to be integrated are aimed at three of the five needs that have been identified as basic to a country's development: food and nutrition, drinking water and environmental sanitation, and basic health care (ul Haq 1977; UNICEF 1977). The integrated programs considered have potentially high and rapid impact on reducing levels of infant mortality, which is one of the three indicators of the Physical Quality of Life Index (PQLI) (Overseas Development Council 1977).

The relationship between infection and nutrition has been documented by major studies in Central America (Scrimshaw, Taylor, and Gordon 1967) and in India (Kielmann 1977; Parker and Taylor 1977). These studies conclude that addressing both needs is desirable and potentially synergistic. The quantity and quality of water appear to play important roles in determining levels of infection and parasitic infestation that commonly affect the nutritional status of vulnerable groups (World Bank 1976; White, Bradley, and White 1972; Zij 1966). Improved water and sanitation facilities have been shown to reduce diarrheal diseases (Schliessman 1959; Zij 1966), although the effectiveness of these interventions, unless integrated with others, has been questioned (Stanley 1977; McGarry 1977; Briscoe 1977).

High parity (Wyon and Gordon 1971) is related to high infant mortality rates, and nutritional status of infants is reduced with short birth intervals. Linking population, nutrition, and health programs seems to increase acceptance and impact (Fernando 1976; Rosa 1967; Omran 1971; Cassazza and Williams 1973). Appendix A in Study VII of this series provides a more complete discussion of biosocial linkages.

B. Organizational Rationale for Integration

Improvement in this constellation of interrelated health and nutrition factors depends both on service delivery and on behavior change by the recipient of the services. Because of the interrelationships, one problem tends to bring the others in its wake. The same low-income family has a poor water supply, inadequate sanitary facilities, and a large number of closely spaced children who become sick and malnourished and die. Transportation problems may make it impossible for them to visit several different service facilities. They may perceive a high risk in innovation and generally will be unwilling to change their behavior unless they gain confidence through contact with an individual or a service structure that can alleviate their fears.

Thus, the same disadvantaged women and children are most likely to require several of the integrated services simultaneously and to have low mobility for obtaining these services from several sources. Moreover, the presence of each service helps reduce the perceived and real risks of adopting innovative behaviors required by the others. Personal confidence in the institution or integrated worker that is established during the adoption of one new service or practice speeds the adoption of the rest of the package (Johnson and Meyer 1977). For these reasons, integrated service delivery can be expected to be more effective. And, in fact, integrated health and nutrition programs have

succeeded in several locations in short periods of time in reducing infant mortality rates by 50 percent (Gwatkin et al. 1980). Increases in family planning acceptance when the service is offered in conjunction with health and nutrition is even more dramatic, with increases up to 3 to 50 percent reported in as short a period as five years as a result of programs in India and other countries (Arole and Arole 1975).

On the cost and delivery side, savings in transportation and in communications efforts result from the use of an integrated worker or facility to deliver several services in the same package. Combining services that were managed separately may economize on scarce management resources; however, the administrative demands of multi-activity programs may strain management capabilities. Successful integrated programs generally develop out of pre-existing vertical programs, are designed through careful assessment of the target group's needs, are tailored to fit the cultural context, and draw on community resources and initiative. The key design issues relate to organization, needs assessment and resource inventory, personnel, service mix, facilities, and supplies and equipment.

II. KEY INTERVENTION DESIGN QUESTIONS

A. How Should the Program Be Organized at the National, State, and Local Levels?

Implementing an integrated strategy generally entails some adjustments in organizational structures at the national, regional, and local levels. At the national level intra- and/or interministerial coordination is necessary. This does not come easily; the formation of an interministerial nutrition committee has frequently proved ineffective (Winikoff 1978, see Appendix A-1). It appears highly desirable to have supraministerial entity with support of the chief of state, in order to exercise budgetary, political, and planning leverage over the other bureaucracies charged with program implementation. While such a unit should ideally reside within the Ministry of Health, the low priority given to health, the predominance of curative approaches, and weak administrative capacities may be a disadvantage. National Planning Ministries of the Office of the President may be more appropriate loci.

The regional level organization is critical because it is the juncture point of top-down and bottom-up communications (Korten 1977a). It is at this middle level that technical expertise, supervision, supplies, and training occur. The variety of institutions that come into play at

this level should depend entirely on the nature of the social, political, and economic structure in a given area and the level of interest of leadership available within the institutions. No institutions should be summarily ruled out—the military, mayors, medical colleges, and agricultural institutes all may play a role.

Active community involvement is essential to integrated programs; programs using village workers are the most cost effective (Ward 1977; Gwatkin et al. 1980). Along with these workers, affinity groups such as mother's clubs also appear to be effective vehicles (Parker and Taylor 1977; Korten and Young 1977). The community may participate at varying levels of responsibility, from total determination of project activities to putting up matching resources of funds and managing much or all of the program in exchange for external assistance, to carrying out a series of tasks delegated by the program structure. A significant number of integrated programs exist primarily at the community level, having bypassed slow-moving vertical administrative structures.

Finally, the effectiveness of an integrated program appears to be enhanced if the organization is results-oriented rather than procedure-oriented, as noted by Korten (1977b):

	<i>Results-Oriented</i>	<i>Procedures-Oriented</i>
Targets/feedback	Outcomes	Activities
Supervision	Supportive	Disciplinary
Training	Problem solving	Routine
Organization	Team	Specialists

B. What Are the Community's Needs and What Resources Can Be Mobilized to Meet Them?

The starting point for designing a program is the assessment of the community's needs, both diagnosed and felt. The integrated worker (IW) plays a key role in gathering the data to identify needs. Weight charts have proved to be a key vehicle for needs assessment; in addition, they serve other functions, such as monitoring and education (Wray 1970, see Appendix A-2; U.S.A.I.D. 1971; Morley 1973). Because weighing identifies the most needy children, the IW should weigh children monthly to measure their progress and assess new needs. To save time, IWs can concentrate on children (and pregnant mothers) with other at-risk characteristics such as those listed on page 29. Normal and near-normal children and mothers can be weighed bimonthly and given the other preventive care.

Arm circumference strips also are effective in identifying malnourished children. Mothers and illiterate IWs have been successfully trained to take circumference measurements (Feferbaum 1978; Zeitlin et al. 1979, Appendix A-3). For preschoolers, an arm circumference of less than 12.5 cm indicates moderate to severe malnutrition; a circumference of 12.5 to 15.5 cm indicates mild malnutrition.

Colors on tapes and weight charts should correspond to the group's color symbolism—e.g., red in parts of India represents healthy; in much of sub-Saharan Africa, it stands for danger. Impact is enhanced if the mother retains the charts, as they seldom lose them (Gopaldas et al. 1975). The charts have also been used to focus entire villages' attention on the needs of the malnourished children (Hendratta 1976).

The previous section indicated the importance of community participation. This extends to the task of needs assessments also. What a community *feels* as needs may not be the same as those needs that external program personnel identify; preschool malnutrition is frequently not perceived as a problem, often because it is not understood. The integrated approach has the advantage of multiple components, thus increasing the chances that felt needs will encompass at least one of the components of the integrated package. Meeting that need can increase community motivation and participation and receptivity to other diagnosed needs.

Central government funds are frequently too limited to meet either diagnosed or felt needs fully, even when strong government will to do so exists. Consequently, one should identify which local as well as which national resources are available. Key local resources are people, materials, meeting facilities, and funds. The provision of local resources represents a confirmation of commitment to the service, reduces external dependence, and increases the chances of program continuance and impact (Arole and Arole 1975). External resources should concentrate on types of inputs that are not available locally, for example, certain medicines or skills.

C. What Are the Key Nutrition, Health, Water, Sanitation, and Family Planning Components of an Integrated Program?

The mix of services should be derived from the needs assessment and resource inventory. The possible nutrition components were discussed in the previous sections of this chapter. A common barrier to effective integration is the failure of different specialists to have a basic understanding of other areas of specialty. The health, sanitation, and family planning components that appear to be most relevant are described

briefly here. (The Service Mix section in Study VII of this series—*Integrated Nutrition and Primary Health Care Programs*—contains a fuller description.)

1. Health

Rehydration—Dehydration can accompany diarrhea; if losses approach 10 percent of body weight, the child's life is threatened. Symptoms include vomiting, anorexia, lethargy, tightening of skin, sunken eyes, severe thirst, and dark yellow urine. Rehydration, which can be carried out in the home, should be started early in the diarrheal episode, which will prevent appetite loss (Hirschorn et al. 1977). The primary function of the therapy is not to terminate the diarrhea but to replace fluids and electrolytes. A glucose-electrolyte solution can be prepared from the four relatively available ingredients shown in Table 10.1. It should be administered in sips and faster if the child can tolerate it, and it should be continued throughout the diarrheal period.

Antiparasite measures—Intestinal parasites, particularly roundworm and hookworm, adversely affect nutritional well-being. A single dose of the anthelmintic drug piperazine will usually get rid of roundworm. Thabendazole can be used for hookworm. Chloroquine can be used for suppression or prevention of malaria, which can particularly affect the nutritional status of women. Reinfection will be high unless more basic sanitation and hygiene measures are taken.

Curative treatment of infection—Paraprofessionals can be trained to treat most common infectious diseases. In Indonesia, 90 percent of all disease complaints are handled with only ten medicines (Hendrata 1976; Sadjimin, Ismangaon, and Rohde 1976). Table 10.2 lists basic medicines and supplies. Of prime importance in treating infection is ensuring that the child receives the proper quality and quantity of food during and after an infection.

Immunization—Approximately 5 million deaths (10 percent of small child mortality) occur each year because of the six common childhood diseases for which immunizations exist (McCord 1977). Yet only about 10 percent of the newborns in developing countries are protected through immunizations (Morley 1977). Malnourished children are not as thoroughly protected by some vaccinations as well-nourished children, thus pointing to the synergy between supplemental feeding and immunizations (Krishman et al. 1974; Gross et al. 1975; Edelman 1977; Katz, Brown, and Plotkin 1966). The time interval between immunizations affects

Table 10.1 Ingredients for Glucose-Electrolyte Solution

1	liter of water
20	g glucose ^a
2.5	g (3/4 teaspoon) baking soda
1.5	g (1/4 teaspoon) potassium chloride ^b

Source: Rohde 1977

^a Sucrose may be substituted (double the quantity), but it is apparently less effective.

^b Orange juice is a good source of potassium.

Table 10.2 Illustrative Village-Level Medicine and Supplies Package

<i>Medicines</i>	
Diseases	Medicines
Diarrhea	Glucose-electrolyte solution or ingredients
Fever/pain	Aspirin
Infections	Sulfanomides, penicillins, ampicillin
Worm infestation	Peperazine, thabendazole
Vitamin/mineral deficiencies	Iron, folic acid, vitamin A, iodine
Malaria	Pyremethamin, chloroquine
Eye infection	Silver nitrate drops (1%) antibiotic eye
Skin infection	Gentian violet (1%)
Cough	Cough syrup
<i>Supplies</i>	
Task	Supplies
Nutrition monitoring	Growth charts, scales, arm circumference strips
Contraceptive distribution	Pills, diaphragms, condoms
First aid	Bandages, petroleum jelly, soap
Fever measurement	Thermometer
Immunization	Cold boxes, dermojets
Birth delivery	Sterile razor blades, sterile ties for cord and gauze, iodine tincture

effectiveness. The need for refrigeration of live vaccines creates severe delivery problems for rural areas.

Prenatal care—Nutrition and health measures for pregnant women are critical. Infections can be transmitted to the fetus (Rosenberg, Solomons, and Levin 1976), and poor maternal nutrition can contribute to low birth weights, which lower survival chances (Mata, Urrutia, and Garcia 1972). Thus, tetanus toxoid immunizations (Berggren 1974), anti-malarials (Morley 1973), and nutritional supplements are recommended.

Health education—Many desirable health practices—e.g., feeding during infection or rehydration during diarrhea—may conflict with customs and beliefs. One should thus accompany the service delivery with education, particularly emphasizing efforts to improve the parents' capacity to handle the health situation (Rohde, Ismail, and Sutrins 1975; Rohde 1977).

First aid—The village-level health worker should be trained in basic first aid measures (treating fevers, shock, bleeding, fractures, burns). These services are felt needs by the community and enhance the worker's credibility.

2. Water/Sanitation

Water supply—Both the quantity and quality of the water supply must be addressed (White, Bradley, and White 1972). Simple wells, handpumps, or standposts that are inexpensive and easily maintained are preferred. On a larger scale, percolation dams may be feasible. Catchment tanks are another possibility.

Water treatment—Means of preventing or eliminating contamination of water supplies include boiling water, sealing wells, using pumps, lining wells with concrete, chlorinating water, filtering water, and controlling supplies. Treatment may have to be intensified during different seasons.

Waste disposal—Pit latrines are inexpensive and effective if constructed away from houses and water sources. Their use, however, may require significant educational efforts. Control of flies through their eradication or through limiting their contact with excrement, garbage, and food are also desirable.

Drainage and spraying—To control water-related diseases such as malaria or onchocerciasis (river blindness), breeding grounds can be attacked through drainage or spraying. This will generally have to be done on a regional basis (Tomiche 1976).

Hygiene education—Access to water will not necessarily improve health status unless adverse hygienic practices related to the transmission of water-washed diseases are altered (Stanley 1977; Saunders and Warford 1976). A change in the choice of water sources does not necessarily involve breaking a custom; rather, it involves cultivating new perceptions of health, convenience, and cost (White, Bradley, and White 1972). Food preparation appears to be an important area for education.

Water storage—Even if water is uncontaminated when it reaches the house, it often becomes contaminated in storage in the home (Schneider, Shiffman, and Faigenblum 1977). Unsanitary, unprotected storage vessels or contaminated dippers can be causes. Ed-

ucation and increased quantities of water to permit more frequent washing can alleviate the problem.

3. Family Planning

Natural methods—Delaying the age of marriage and increasing the intervals between births are means of reducing the population rates. These changes are likely to occur due to larger socioeconomic trends, but the IW can reinforce the desirability of these methods. Prolonged breast feeding also inhibits ovulation (Jelliffe and Jelliffe, 1972). Lactation can triple menorrhea. The rhythm method is another approach, but its effectiveness is hindered because of irregular menstrual periods, which are caused in part by poor nutrition (Frisch 1975).

Pills—Taking birth control pills is probably the most effective means of birth spacing, but irregularity of supply and consumption is a disadvantage. The IW can be of assistance in both providing pills and reminding the women to take them. Adverse nutritional side effects such as nausea, bleeding, disturbance, and folate deficiency (Edelman 1977) may occur.

IUDs—Intrauterine devices can be inserted by a properly trained midwife or IW. However, discomfort and bleeding may occur, making follow-up critical. An oral iron supplement should also be given to women who experience heavy bleeding.

Diaphragms and condoms—These are inexpensive and effective measures that can be widely distributed through commercial channels.

Sterilization—The tubectomy (for women) is more common than the vasectomy (for men). Because of the generally irreversible nature of these procedures, caution should be used. "Forced" sterilization can carry severe political repercussions.

D. What Personnel Should Be Used and How Should They Be Trained?

Attention must be given to the selection, responsibilities, coverage, and training of basic personnel, and to the personnel who supervise them. A critical part of integrated programs are village-level integrated workers (IW) who may have multiple functions or single functions within an integrated delivery system. The previously discussed needs assessment would help decide on the precise service mix. Integrated workers have proved more cost-effective than physicians in delivering primary care (Fendall 1971; PAHO 1969).

The community should choose an IW based on consideration of the person's empathy, credibility, and stability. The IW's educational level is less important than these other factors, although literate personnel are preferable to illiterate personnel if they fulfill the other criteria. Sex, age, task structure, and training methods will vary greatly, depending on local organizational and social structures. Men and women teams or older and younger women combinations have proved effective in some situations. If only one IW is employed, a female worker is usually preferred because the greater part of an IW's responsibilities pertain to women and children. Men are favored if major emphasis is placed on environment sanitation matters.

The IW's tasks should be defined through formative evaluation if possible; that is, several alternatives may be discussed and tried on a small scale to see which proves most serviceable to all concerned. Although the specific tasks of the IW or IW teams will depend on the particular conditions of the site, the following types of responsibilities can be effectively carried out:

- providing outreach
- assessing community needs
- serving as a liaison with the regional office personnel
- providing health education
- supplying parts or simply maintenance for water systems
- supplying medicines, food supplements, and contraceptives
- collecting vital statistics

In the assignment of these responsibilities, however, great care must be taken to avoid overburdening the workers in terms of the number of tasks relative to their capacity or number of families to be served relative to available time.

The IW-to-client ratio also will depend on many factors, including the number of hours per week that the IW can realistically work if he or she is a volunteer, the range of tasks, the population density, the terrain, and transportation facilities. Generally, paid workers can be expected to cover a wider radius than volunteers. A ratio of one worker to 100 to 200 families has proved effective in some instances (Pahlavi University 1976; Berggren 1977). The volunteer, on the other hand, may be most effective when he or she works with only 10 to 30 households in the immediate neighborhood (Sidel and Sidel 1973; Solon 1973; Lampang Project 1975). Again, formative evaluation can help determine the proper ratio before a plan is institutionalized.

The capacity and impact of the IW will be directly influenced by the training and supervisory support system. Because the personnel at the intermediate or regional level provide these functions, they must

be competent in one or more of the technical services that the IW provides; they must also have the administrative competence to handle efficiently the supply logistics and meet the IW's referral needs. For IWs, a short initial orientation and instruction period followed by on-the-job training has been found most effective. The training courses should be action-oriented and practical (Rohde 1977).⁴ The IW must learn to be able to distinguish the signs and symptoms to which they must react and must learn in detail the steps they must take in each situation. In addition, they must learn the precise limits of their capabilities and when and how to use the referral system.

Intermediate-level personnel must also understand their "fit" with the integrated worker and the referral system. This generally requires close coordination among different ministries or departments with which the various technical personnel are affiliated. A "team" approach is needed in both training and service delivery. Thus, the need for interinstitutional coordination and cooperation cited earlier is critical in this aspect of implementing integrated programs.

E. How Can Facilities and Supplies Be Shared or Coordinated?

Facilities required for integrated activities need not be elaborate. Central health clinics can serve as regional referral and supply distribution points, but village-level centers designated by the communities (e.g., in schools or churches) are needed to ensure proximity to the beneficiaries. The stronger the outreach and domiciliary contact, the less need there is for integrated village facilities. The IW, not the facilities, is the integrating mechanism.

However, logistical support facilities and equipment such as warehouses and vehicles can be shared; such integration can increase efficiency and reduce administrative overlap and costs. A central system for the procurement of supplies may also realize savings.

F. How Quickly Should Integrated Programs Be Established?

Integration is an organizationally difficult task, especially where existing bureaucracies resist changing their traditional roles. Furthermore, people-oriented activities such as organizing the community and changing behavior patterns take considerable time (Bradley

⁴The World Health Organization (1974) has published a useful training manual for village workers.

1977). There is a "break-in period" of a year or two. Political pressures for results may create unrealistic expectations for short-run results.

The pace of implementation will have to be compatible with the personnel and organizational capacities to absorb the change and the communities' acceptance of it. It may be strategically desirable and necessary to integrate in stages, the more feasible and desired components being integrated first to gain the community's belief in the program.

III. COSTS AND EFFECTIVENESS

Costs and effects should be high on the list of aspects of integrated programs to be evaluated, as is true with other interventions. Such evaluation faces two basic limitations: data are very scarce and program design differences reduce comparability. Within these limitations, we will present partial cost and impact data and evaluation considerations.

A. Costs

In the health component of integrated programs, we estimate that it would cost \$1.50 to \$3 per capita for the principal vaccines. The cost of such immunization is largely determined by the number of contacts per child. The use of IWs might reduce the number of separate visits and thus increase efficiency. Other items could be delivered simultaneously, such as anti-malaria pills, vitamin A or iron capsules, or contraceptives.

The cost of water supply systems can vary considerably depending on local conditions. However, the World Bank (1976) estimates that wells fitted with hand pumps for a village of 1000 would cost \$.50 to \$3 per capita. The cost of sanitation facilities can also vary tremendously, according to the complexity of the facilities. Pit latrines can cost as little as \$10 for a hole and slab and as much as \$200 for a vault, concrete slab, and sound shelter.

The various supplemental feeding programs cost around \$10 to \$20 per recipient per year. Fortification with vitamins or minerals costs around \$.002 to \$.10 per recipient per year.

The important aspect of intervention costs for integrated programs is the efficiencies that can be derived through the integration. In Narangwal, a 20-percent savings was achieved when nutrition supplementation was integrated with infection control measures; the cost decreased from \$24.04 to \$20 per beneficiary. An additional 16-percent savings was reported when the family planning and women's services

Table 10.3 Mortality Rates in Four Integrated MCH-Nutrition Programs

	Population Receiving Services		Population in Same Area Without Services	
	Infant Mortality Rate	Age 1-4 Mortality Rate	Infant Mortality Rate	Age 1-4 Mortality Rate
Imesi (Nigeria)	57.3	18.0	91.4	51.2
Guatemala	55.4	5.9	84.7 ^a	22.0 ^a
Narangwal (India)	95.9	10.1 ^b	126.5	16.3 ^b
Jamkhed (India)	39.0	2.0	90.0	2.0
Harover (Jamaica)	10.6	5.6	47.0	14.5
Katihar (India)	64.3	n.a.	127.7	n.a.

Source: McCord 1977; Gwatkin et al. 1980.

^a From official statistics, which are probably low estimates.

^b Mortality rate for one-to three-year-olds.

were added to the combined program for the children instead of being delivered separately (Parker and Taylor 1977).

The fiscal burden to the government of these integrated program costs can be reduced via beneficiary fees. Low-income families expend perhaps \$3 or more per capita for private health care, which is generally greater than the amount governments spend on public health care. Studies of several integrated programs have shown that people will pay for health services if they have confidence in them (Arole and Arole 1975). There is also evidence that villagers make better use of their water systems when they have contributed resources to obtain these services (Saunders and Warford 1976).

A final note on costing is that one should consider the cost of the program to the parents in terms of their time (lost wages), transportation expenses, and other inputs, such as food or labor. Village-level, IW-centered programs tend to reduce these costs relative to clinic-based programs.

B. Effectiveness

Evidence of health effects, like costs, are fragmentary. But even these are sufficient to suggest the effectiveness of integrated programs. Table 10.3 shows that four integrated programs were successful in lowering mortality rates of infants and 1- to 4-year-olds 30 percent to 75 percent.

An integrated program in Nigeria showed that the group receiving the integrated packages of nutrition supplement, malaria prophylaxes, and immunization performed better in terms of growth and mortality than groups receiving only single components (Edozien 1970).

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Chapter 11

Concluding Observations

James E. Austin and Marian F. Zeitlin

I. INTRODUCTION

In this chapter we will first present our general conclusions on intervention impact and costs. Then we will comment on factors that appear to be especially critical to intervention effectiveness.

The foregoing chapters provided guidelines for the analysis and design of several types of interventions. This chapter will make some final observations that cut across the various interventions. It is important to reiterate that our conclusions should be viewed as tentative because of the limitations in the quality and quantity of the data we reviewed and in the scope of our investigation. Our investigations have not been exhaustive, but we do believe they are reasonably representative of nutrition interventions oriented toward preschoolers in the Third World. Finally, the application of these findings to the development or operation of nutrition programs must recognize the uniqueness of each country and community. Although commonalities exist, there are no standard approaches or packages; each intervention effort must be tailored to the specific social, political, economic, and institutional characteristics of each situation.

II. INTERVENTION IMPACT AND COSTS

The first conclusion from our review of the impact of interventions on nutritional and health status is that there is no quick solution—no panacea. We should not expect dramatic, rapid improvement. Malnutrition is not a bacterial disease that can be cured within a matter of weeks or months through the administration of an antibiotic. Rather, its causes are multiple, and its interrelationships with health, environmental, economic, and social conditions are complex. Nonetheless, our review has given us sufficient evidence to conclude that the well-being of nutritionally deprived groups improved more quickly as a result of each type of intervention—if properly designed and managed—than it would have in the programs' absence. The extent of the impact varies by type of intervention and situational circumstances, but the greatest impact seems to occur both where there is a combination of various direct nutrition interventions (e.g., supplementary feeding and nutrition education) and also where there is a combination of direct and indirect nutrition interventions, particularly health care. Interventions fail, we found, primarily because of deficiencies in design and because of implementation problems not adequately addressed in the design. Careful, systematic design increases the probability of successful implementation. Thus, the lack of greater impact of past nutrition programs is not an accurate indicator of the future potential benefits from such general types of interventions.

The costs of nutrition interventions are not prohibitively expensive for developing countries. External funding is frequently very useful in the early stages, but it may be neither necessary nor desirable on a continuing basis. Channeling increased public expenditures toward nutritionally deprived groups—is generally necessary; targeting, inherently, is a redistributive process. The mobilization of community resources also increases financial feasibility, for program beneficiaries will pay for services that deliver perceived benefits. Costs per individual improved may appear high, but the percentage of the population represented by low-income, pregnant and lactating mothers and preschoolers is relatively small (around 10 percent). Consequently, the total financial requirement—the per-capita program costs multiplied by the total number of target group members—is not fiscally unrealistic. The government does not have to serve the entire population, only the smaller target group. Total outlays are generally within the fiscal capacity of most developing countries, although it may require shifts from non-nutrition expenditures.

Table 11.1 presents some summary estimates of cost and impact data for the seven intervention categories. These figures should be

Table 11.1 Summary Estimates of Intervention Costs and Impact

	Costs	Impact
Supplementary feeding	\$10–\$25 per recipient per year	Positive growth impact over 4- to 24-month period.
Nutrition education	\$.05–\$3 per recipient	Changes in feeding practices documented; positive biological effects suspected.
Formulated foods	\$.001–\$.003 per g of protein; \$.007–\$.014 per 100 calories	Positive growth impact when used in NRCs with severely malnourished.
Fortification	\$.002–\$.11 per recipient per year for micronutrients; \$2.50 per recipient per year for lysine fortification	Goiter largely eradicated in some areas; vitamin A blood serum levels increased; iron fortification led to increased hemoglobin and hematocrit levels. Lysine fortification did not yield growth improvements where calories were adequate.
Consumer price subsidies	1%–25% of total government expenditures	Has provided up to 30% of calorie requirements of low-income groups.
Agricultural production	Depends on nature of project	High potential but depends on income, employment, and price effects on target groups.
Integrated programs	\$15–\$50 per beneficiary per year, 5%–20% cost savings over nonintegrated	Infant mortality rates decreased 30%–75%.

viewed as rough due to the deficiencies, insufficiencies, and non-comparability of much of the underlying data reported in the literature. Following are some concluding observations on these interventions:

Supplementary feeding. This type of intervention (both take-home and on-site) should be undertaken, but it is imperative that it be designed to reach children in the 6- to 24-month category and pregnant women. Past programs have failed to reach these groups adequately, and impact has been lessened accordingly. Although the outlay is costly, sharper targeting to the needier, more vulnerable groups can reduce leakages and improve cost-effectiveness.

Community-level NRCs are effective vehicles for aiding the recuperation of the severely malnourished.

Nutrition education. Documentation on costs and effectiveness is very scarce for the nutrition education interventions; however, they do seem very appropriate in areas where the weaning-age child is nutritionally deficient due to feeding practices rather than absolute food shortages at the family level. Combining mass media and face-to-face approaches appears to offer the greatest potential for maximizing impact.

Fortification. Where goiter exists, iodization should be undertaken; it is inexpensive and has proved highly effective in eradicating this deficiency. Vitamin A, vitamin B, and iron fortification are also low-cost programs that appear able to have a positive impact on reducing these micronutrient deficiencies. Protein fortification is relatively much more expensive and is of questionable value if the target group also is suffering from a calorie deficiency.

Formulated foods. These should be developed where existing weaning foods are nutritionally inadequate. In rural areas where needy families can grow the necessary legumes and staples, the preparation of multimixes in the home should be encouraged. This requires a major nutrition education effort. For urban dwellers, industrially processed formulated foods might be more appropriate. However, the neediest groups will not generally be able to acquire these foods unless the price is lowered by means of government subsidies. Formulated foods should be used in supplementary feeding programs.

Consumer food price subsidies. This intervention directly addresses the income constraint and has proved effective in increasing calorie and protein consumption of needy families. The actual impact on the nutritional status of preschoolers and pregnant or lactating women is less clear, although some programs appear to have contributed to lower infant mortality rates. The programs can impose a significant and perhaps unsustainable financial burden on government budgets. Unless the subsidy is sharply targeted to the vulnerable groups, the high costs make the program's cost-effectiveness as a vehicle for achieving nutritional improvement questionable. However, this does not mean that such subsidies are not effective mechanisms for achieving other broader income distribution or political stability goals.

Agricultural production. The major challenge in the agricultural area is to institute explicit nutritional impact criteria in the design of agricultural production policies and programs. In other words, the key is to formulate agricultural interventions such

that they ensure that the income, employment, and price effects from increased production lead to positive nutritional benefits for the various target groups—poor rural families, farm laborers, and urban dwellers. Failure to use such an orientation can mean that choices concerning production technologies, crop selection, and farmer groups could lead to negative rather than positive results for the nutritionally needy.

Integrated programs. The combination of direct and indirect nutrition interventions appears to generate the greatest impact. A precise incremental quantification of the relative benefit of various intervention combinations does not exist, but the desirability of multiple, coordinated interventions is clear. Given the multiple factors contributing to malnutrition, it is not surprising that integrated approaches appear to be most effective. Integration can take many forms. The most powerful combination appears to be direct nutrition interventions accompanied by primary health care. The combination is preventive and curative. Nutrition education should accompany supplementary feeding and formulated foods interventions. Agriculture sector interventions, consumer price subsidies, and fortification appear to be less interdependent with other interventions.

Nutrition programs also seem more effective when they are integrated into larger development efforts rather than viewed as tangential undertakings. Such integration could perhaps be usefully accomplished if "nutritional impact assessments" were incorporated into the policy process of the various ministries. It may well be that full integration will occur only when the nutrition variable becomes a conscious and explicit component in development policymaking and evaluation.

The ultimate impact of a particular intervention depends not only on its economic feasibility, but also on how well it overcomes administrative and political problems. As an illustration, Table 11.2 force-ranks the seven intervention categories against the criteria of administrative and political feasibility. The gradations are imprecise, the rankings would vary by situation, and combinations are not considered. Nonetheless, the table does show why it is important for planners to consider the relative positions of interventions against these administrative and political criteria as well as against those of economic feasibility and nutritional impact; strength in one category may have to be balanced against weakness in another. It also highlights areas in which special design efforts might be needed.

In short, nutrition interventions are affordable, desirable, and feasible.

Table 11.2 Illustrative Ranking of Interventions

	<i>Criteria</i>	
	<i>Administrative Feasibility</i>	<i>Political Feasibility</i>
Supplementary feeding	4	1
Nutrition education	2	2
Formulated foods	3	6
Fortification	1	5
Price subsidies	5	3
Agricultural production (nutritionally oriented)	4	7
Integrated programs	7	4

1 = highest; 7 = lowest.

III. COMMUNITY PARTICIPATION

Although conclusive documentation is not available, active community involvement in the initiation, design, and operation of nutrition programs appears to be a critical success determinant for many types of interventions. This participation begins with the expression of needs. Nutrition programs should be shaped around felt needs and should evolve in accordance to community desires. Outsiders can play an important catalytic role in this needs assessment process, but interventions imposed through top-down planning without two-way communication between program designers and the population to be served generally appear doomed to failure. Community support is critical. Agricultural policy, consumer food price subsidies, and centralized fortification appear implementable without such direct community involvement. Even with these interventions, however, a thorough understanding of the target group's food preferences and purchasing behavior is critical.

Participation can be viewed as a development goal in itself—a vehicle for increasing one's capacity to control and shape one's environment, thus achieving greater self-reliance. However, there are also at least three very pragmatic reasons for deep community involvement. First, one of the major stumbling blocks to successful implementation is local organization; community groups can perform this task. Second, the community can provide local resources such as labor and facilities, thereby reducing the financial constraints. Third, involvement increases motivation and commitment to achieving the goals of the undertaking.

Eliciting meaningful community participation is time-consuming and often slow. It represents a significant "front-end" investment of time and effort, but it provides a foundation that enhances the chances of continuity and impact.

IV. VILLAGE WORKERS

One major way for communities to become involved in and to control the nutrition programs is to participate in the selection and supervision of local village workers. It has been amply demonstrated that individuals from the villages can competently perform the bulk of nutrition and health services. Their effectiveness, however, appears dependent to a great extent on the quality of training, support, and supervision they are given. Thus, these aspects of programs (which have often been neglected) should be given priority.

More costly doctors and other medical and nutrition professionals should be concentrated at higher levels as part of a referral system. However, the focus of the interventions should be on the village.

V. LEADERSHIP

The best documented and most effective interventions have almost always been directed by strong leaders who were deeply committed, professionally competent, and innovative. These efforts have generally been smaller, pilot projects. This raises an important issue: whether such undertakings can be expanded to a larger scale and still be effective.

There is no doubt that such leadership is a scarce resource in any society. Bureaucracies and civil service are not generally fertile grounds for charismatic leadership. Perhaps one key is in ensuring strong political support from top levels; this can help motivate bureaucracies. A second approach is to increase reliance on the communities. Their capabilities for action are generally much greater than presumed, if modest catalytic inputs are provided.

VI. MANAGEMENT

Charisma and dedication may be necessary conditions for success, but they are not sufficient. Skilled program administration has also been present in the most effective interventions. A nutri-

tion delivery system is not a simple undertaking; it requires the systematic mobilization and management of multiple resources to ensure effective implementation. Too often the potential benefit of a thorough problem diagnosis or a carefully thought-out national nutrition policy is lost because of poor management. This is attributable to both people and process deficiencies. Management and implementation should be key focal points for the nutrition community as it moves forward.

VII. TARGETING

The impact and cost-effectiveness of nutrition intervention can often be increased if they are directed toward the most nutritionally needy groups. Low-income pregnant and lactating women and preschoolers, especially those under three years old, are the most vulnerable groups.

The most effective nutrition programs in both socialist and non-socialist countries have recognized the need to rechannel increased resources toward groups who have received the least care in the past and who are most at nutritional risk. The sharper a program is targeted, the fewer resources are diverted to less needy groups. In the face of economic scarcity, this is highly desirable. However, the planner should compare these savings with the costs—economic, social, and political—of instituting the administrative controls necessary to target more sharply.

VIII. EVALUATION

As has been expressed earlier, most nutrition programs do not adequately collect and analyze cost, impact, and operating data. The lack of such information greatly hinders the capacity of communities, managers, funders, and politicians to make reasonable decisions about the programs. The more effective programs have had surveillance and information systems as an integral component. These systems provide data feedback critical to improving program performance, motivating beneficiaries, and generating needed financial and political support.

The form of the evaluation system should vary, but its basic components can follow those discussed in Chapter 3. One fundamental requisite is that the system be tailored to the needs of the various end users.

IX. CONCLUDING COMMENT

The pressing need for the type of information produced through nutrition evaluation was a basic motivating factor in carrying out our research. We hope that the data presented here and in the seven special studies will help fill, in part, the existing information gap and provide guidance to those who will carry on the struggle against malnutrition.

The deprivation, suffering, and erosion of human capital caused by malnutrition is intolerable. As long as malnutrition is present, the goals of true development and social justice remain unattained. Urgent and increased actions by governments and international development agencies are essential. Channeling greater resources toward nutrition interventions as part of a development strategy reoriented toward meeting basic needs could go far toward removing the scourge of malnutrition.

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Appendix A

Selected Bibliographies on Nutrition Planning and Evaluation and on the Main Types of Nutrition Intervention

APPENDIX A-1 NUTRITION PLANNING AND EVALUATION

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APPENDIX A-2

SUPPLEMENTARY FEEDING

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APPENDIX A-3 NUTRITION EDUCATION

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APPENDIX A-4 FORMULATED FOODS

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Appendix B

Intervention Design Checklists

APPENDIX B-1 SUPPLEMENTARY FEEDING

1. *Community Participation**

- How is the community participating in planning, design, and operation of the intervention?
- Who in the community is involved and what is the nature of their influence?
- Has the community expressed a clear desire for the nutrition program, or is it being imposed?
- Does the community have other, more pressing needs?
- Can nutrition be related to these?
- What resources is the community willing to contribute to the program?
- Can resident community workers be trained and incorporated into the intervention?
- How strong is the community's commitment to participate?
- How are community desires and ideas being integrated with central government planning?
- Will the program lead to greater self-reliance in the community?

*This series of questions is also applicable to all the following types of nutrition interventions.

2. *Participant Selection*

- How are the participants for the program being selected?
- Are explicit nutritional risk criteria being used?
- Is the program being targeted to at-risk 6- to 36-month-old children and pregnant and lactating women?
- Are moderately and severely malnourished children being given preference?

3. *Food Choice*

- Has the acceptability of the food been tested?
- Does the food have an adequate calorie and protein balance?
- Does it contain need micronutrients?
- Have advantages and disadvantages of using imported food been adequately considered?
- Is the shelf-life of the food sufficient?

4. *Supplement Size*

- Have the deficits of a representative sample of malnourished children been documented through dietary analysis?
- Have these surveys covered consumption at different seasons of the year?
- Have the leakages to non-target-group members been qualified?
- Does the supplement size cover the deficit as well as the expected leakages?

5. *Time Dimension*

- Are the children being reached during the critical 6- to 36-month period?
- Are the pregnant women being reached during their last trimester?
- Are program coverage or supplement size to be increased during "hungry seasons," if they exist?
- Does the plan for timing of on-site meals or the distribution of take-home supplements reflect consideration of the time requirements and convenience of the participants?
- Is there a growth-monitoring system to ascertain when a child is able to leave a program?
- Have criteria been set to determine when a program is no longer needed in a specific community?

6. *Site Location*

- Have nutritional surveys documented the areas where the need is greatest?
- Is the site located in these areas?
- Can existing infrastructures be used, or will new facilities be needed?
- Is the site close enough for needy mothers to reach on foot?
- Is the site located in a place that is culturally acceptable for the neediest to attend?

7. Facilities

- For on-site programs or NRCs will potable water and lavatory facilities be available?
- Are weighing scales and other equipment available for measuring the growth of participants?
- Are measuring devices available for ensuring standard size rations?
- Is the kitchen efficiently laid out and hygienic preparation possible?
- Do day-care facilities have simple toys and play areas to permit intellectual and physical stimulation?
- Are utensils available for preparing and serving food?

8. Logistics

- Does the procurement system use interchangeable foodstuffs to ensure continuity of supply?
- Do the procurement contracts specify quality parameters and guarantee delivery?
- If the food is from international donors, can multiyear commitments be negotiated?
- Do adequate transportation and storage procedures exist?
- Does an inventory control system exist?

9. Costs*

- What are the costs of the intervention inputs (goods, services, labor, utilities, equipment)?
- How will these costs change over time due to inflation, program expansion, and design modifications?
- Have project budgets been made?
- Do social costs differ from the nominal, accounting costs?
- What resources can be tapped to finance program costs?
- How do these costs relate to program impact?

10. Effectiveness*

- What dietary changes are expected?
- What changes in nutritional status are expected?
- What changes in mortality or morbidity are expected?
- Does a monitoring system exist to adequately document program impact?

**APPENDIX B-2
NUTRITION EDUCATION**

1. Problem Diagnosis

- Have representatives of groups that will be involved in implementing and participating in the program been involved in diagnosing the problem?

*These questions apply to all interventions

- Is there a central nutrition education unit that coordinates activities?
 - Have existing studies on nutritional status, food practices, and attitudes been reviewed?
 - Where data gaps exist, have new sample surveys been undertaken?
2. *Community Participation* (See Supplementary Feeding Checklist)
3. *Attitude and Behavior Change*
- How credible are the individuals and institutions providing the education?
 - Is the educator a good role model?
 - Do the motivating factors include social approval or desire for healthy children?
 - Do the teaching practices stimulate change, e.g., by enlisting community leaders, demonstrating new behavior, reinforcing correct practices, eliciting public commitment?
 - Will the approach facilitate diffusion throughout the community?
4. *Themes and Messages*
- Have priority themes been identified?
 - How risky do the target group mothers perceive the recommended behavior change to be?
 - Are the themes broken down into action messages through formative evaluation?
 - Are the messages tailored to the particular situation and characteristics of different target groups?
5. *Nonformal Education*
- Is the education scheduled to minimize learner group inconvenience?
 - Do the teaching methods allow the learners to observe causal relationships?
 - Are traditional modes of communication—such as stories, songs, or drama—used?
 - Are intermediate-level workers training community-level workers?
 - Are the educational facilities and demonstrated behavior change replicable in the homes of the target groups?
 - Can the education be combined with other development activities?
6. *Mass Media*
- What mass media channels are available?
 - Can the mass media and informal approaches be combined synergistically?
 - Have the media modes been matched to the phases in the behavior change process?

- How extensively does each possible mass medium reach the target group?
- Which mass medium appears to have the greatest impact on the target group?
- Have the radio themes been sufficiently broken down into component actions to fit effectively into a spot format?
- Are pictorial materials realistic, familiar, and appropriately sequenced, and do they carry the correct color associations?
- Have the materials and messages been tested with the target group?

7. Adult Literacy

- Is there an adult literacy campaign?
- Can nutrition themes be incorporated?

8. Schools

- Is nutrition incorporated into the school's curriculum?
- Can the students be involved in the growing and preparation of the food?
- Can the student be taught to detect malnutrition?
- Can the schools be used as conduits for educating parents?

9. Health and Other Professionals

- Do existing health professionals and other community extension workers receive nutrition education?
- Can nutrition texts be adjusted or incorporated into curriculums?
- Can other professionals be incorporated into field nutrition programs that serve as training vehicles?

10. Policymakers

- How aware are policymakers of the nutrition problem?
- How motivated are they to take action?
- What means would be most powerful in creating awareness, concern, and action among them?

11. Costs and Effectiveness (see Supplementary Feeding Checklist)

**APPENDIX B-3
FORMULATED FOODS**

1. Nutrient Content

- Does the nutrient content of the weaning food conform to the updated PAG guidelines?
- How does the nutrient content fit with the documented nutrient deficits and food use of the target group?
- Is there a risk of toxicity?

2. *Raw Materials*

- Are the ingredients cheap, available, practical, and culturally acceptable?
- What are the advantages and disadvantages of various nutrient sources?
- Will the procurement system ensure an adequate quantity and quality at the right time for a reasonable price?

3. *Alternative Forms*

- For in-home mixing, will the necessary ingredients be available?
- Is a nutrition education component present?
- Will the adoption of the in-home weaning food make the family more receptive to other innovations?
- For village-level production, who will carry out the production operation?
- What facilities will be needed?
- How will the product be distributed?
- For industrially processed foods, what facilities and personnel will be needed?
- Can existing food processors produce the product?
- How will it be distributed?
- What quality control procedures are used?

4. *Consumer Acceptability*

- Have food habits, preferences, and taboos been documented?
- Have field trials and acceptability test been carried out?

5. *Distribution, Promotion, Pricing*

- For industrially processed or village-level processed foods, can commercial outlets be used?
- Do target-group families patronize these stores?
- Can the foods be used in government feeding programs?
- Will the packaging provide adequate shelf-life?
- Will there be adequate promotion of the new weaning foods to ensure adoption? (See Nutrition Education Checklist.)
- How will the product be priced?
- Will subsidies be necessary to ensure access by needy groups?

6. *Costs and Effectiveness* (see Supplementary Feeding Checklist)

APPENDIX B-4 FORTIFICATION

1. *Nutrient Needs*

- Have the specific nutrient deficiencies been identified?
- Have regional and seasonal differences been documented?
- Have the nutrient interrelationships been analyzed?

2. Fortificant Quantity

- Does the quantity cover the deficit of the neediest groups?
- How does the quantity of the carrier consumed influence the nutrient intake?
- Have processing, storage, or cooking losses been condensed?
- What is the risk of toxicity?

3. Carrier Selection

- Is the carrier consumed on a regular basis by the target group?
- Have systematic acceptability trials of the fortified product been carried out?
- How does the fortification affect cooking procedures, storability, and cultural norms?
- Where and how does the target group participate in the commodity system selected as the carrier?
- Is a decentralized, village-level fortification feasible and desirable?
- Is centralized fortification feasible?
- What are the costs of overcoverage from centralization versus the costs of control from decentralization?
- What are the technical constraints in terms of the fortificant's form, stability, biological availability, and organoleptic effects?
- Is reliable and appropriate equipment available?
- Does the process ensure uniform distribution of the fortifier in the carrier?
- Do appropriate quality control measures exist?

4. Costs and Effectiveness (see Supplementary Checklist)

APPENDIX B-5

CONSUMER FOOD PRICE SUBSIDIES

1. Targeting

- Does the needy group participate in the cash market?
- Is targeting by income levels feasible given bureaucratic capabilities and political sensitivities?
- Is geographical targeting desirable and feasible?
- Can targeting on the basis of nutritional at-risk factors be accomplished?
- What are the costs of administering a more sharply targeted program versus the cost of subsidized foods going to nonneedy groups?

2. Commodity Choice

- Is the commodity regularly consumed by the target group?
- Is it also consumed by nonneedy segments of the society?
- Is the product acceptable to the target group?

- Does the product have a high-income elasticity among low-income consumers and a low-income elasticity among high-income consumers?
- Will an adequate supply of the commodity be available?

3. *Rationing*

- Is the product scarce?
- Do higher-income groups demand the product?
- Does the ration size meet the target group's deficit and cover leakages?
- What is the government's administrative capability to operate the rationing system?
- What will occur if the ration privilege is transferable?

4. *Pricing Policy*

- Can the extent of the subsidy be varied in accordance with family income and nutritional need levels?
- Will price controls lead to black markets?
- Will the subsidized prices be reviewed periodically?
- Can margins be regulated?

5. *Distribution Systems*

- Can the existing retail network be used?
- Will coverage of the target group be adequate?
- What types of incentives and controls will be needed?
- Is it necessary to mount government stores?
- How much capital will be required?
- Should a parallel free market be permitted?
- What extent of diversion can be expected?

6. *Costs and Effectiveness* (see Supplementary Feeding Checklist)

APPENDIX B-6

AGRICULTURAL PRODUCTION, TECHNICAL CHANGE, AND NUTRITIONAL GOALS

1. *The Relationship of General Economic Policy to Nutrition Policy Instruments*

- Under what policy conditions will increases in agricultural production result in lower domestic food prices?
- If food prices are held stable, what factors influence the amount of time before a country reaches food self-sufficiency?
- What implications does the degree of dependence on food imports have for agricultural policies aimed at lowering domestic food prices?

2. Price Effect

- What economic characteristics determine the extent to which the target population will benefit from lower food prices?
- How will the target population's consumption pattern shift among foods and nutrients in response to changes in food prices?
- What is the relationship between target-group food consumption behavior and the formulation of agricultural policy dealing with technology development, crop improvement, and infrastructure investment?
- How is the consumption impact of an increase in supply of one crop influenced by the conditions of substitution among crops in the agricultural sector?

3. Employment and Income Effects

- How does the functional relationship between the target group and agricultural production influence the potential impact of increases in production on food consumption?
- How appropriate are new biological (e.g., high-yielding seed varieties) and chemical (e.g., fertilizer) technologies for adoption on small farms?
- Why are crop-specific factors in addition to capacity for generating net income important?
- How does the nature of agricultural expansion influence the decline or expansion of agricultural employment?
- How does the character of new technology influence employment growth?
- How does price policy influence the adoption of technology?
- How does price policy influence the impact of new technology on employment and wage rates?
- How important is agricultural growth to the generation of employment and wage income in nonagricultural sectors?

4. Price Versus Income Strategies

- What is the relative importance of various crop characteristics in the context of nutrition policy strategies employing price effects and income effects, respectively?
- Under what conditions does a price-oriented versus income-oriented food policy lead to conflicting implications for agricultural policy and resource allocation?

5. Short-Run and Longer-Run Policy Conflicts

- What are the investment requirements of agricultural growth?
- What is the potential role of agricultural growth in the generation of revenue for food subsidies?

6. Costs and Effectiveness (see Supplementary Feeding Checklist)

APPENDIX B-7
INTEGRATED NUTRITION AND PRIMARY
HEALTH CARE PROGRAMS

1. *Program Organization*

- Is there an inter-ministerial coordinating committee?
- Does it have adequate budgetary, political, and planning leverage over the implementing bureaucracies?
- Has the middle-level supervisory and support system been adequately staffed and organized?
- Has the community been actively involved? (See Supplementary Feeding Checklist.)

2. *Community Needs and Resources* (see Supplementary Feeding Checklist)

3. *Personnel*

- Have village workers been selected?
- Have their tasks been assigned?
- Have they received adequate action-oriented training?
- Are their responsibilities compatible with their time availability and skills?
- Do intermediate personnel have adequate technical competency to supervise and support the integrated workers?
- Are the various technicians' activities coordinated?

4. *Key Components*

- Did the health component consider rehydration, antiparasite measures, curative treatment of infections, immunization, prenatal care, health education, and first aid?
- Did the water and sanitation component consider water supply and storage, waste disposal, draining and spraying, and hygiene education?
- Did the family planning component consider natural methods, pills, IUDs, diaphragms and condoms, and sterilization?
- Did the direct nutrition component consider supplementary feeding, nutrition education, formulated foods, fortification, consumer price subsidies, and agricultural productivity?
- Are the components responsive to felt and diagnosed needs in the community?

5. *Facilities and Supplies Coordination*

- What facilities and supplies does each component use?

- Which of these can be shared or jointly procured, stored, or distributed?

6. *Timetable*

- Is the timetable for mounting the integrated program compatible with the personnel and organizational capacities?
- Should the components be integrated in stages?
- Can the more feasible and desired components be launched first?

7. *Costs and Effectiveness* (see Supplementary Feeding Checklist)

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